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TECHNICAL REPORT 4911

AERODYNAMICS, DIMENSIONS, INERTIAL PROPERTIES, AND PERFORMANCE OF ARTILLERY PROJECTILES

HENRY E. HUDGINS, JR.

JANUARY 1977

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The best available aeroballistic information on currently fielded and in-development US Army artillery projectiles (105mm and up) for indirect fire has been collected or generated and is discussed in the main report. The aeroballistic data includes: dimensions and inertial properties, zoning, compacted firing tables, dispersion, sensitivity coefficients, aerodynamic coefficients estimates, and a bibliography of lethality and vulnerability. A bibliography and available data on guided projectile

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20. ABSTRACT (contd)

aerodynamics is also presented. A similar effort for Soviet munitions is reported in the addendum to this report which also includes classified data on US weapon systems.

ACKNOWLEDGEMENT

Many people cooperated in providing the information collected in this report and its addendum. The major contributors by organization were: Aeroballistics Branch of the Feltman Research Laboratory, Ammunition Development and Engineering Directorate, Nuclear Development and Engineering Directorate and the Foreign Intelligence Office, all at Picatinny Arsenal, and the Exterior Ballistics Laboratory of the Ballistic Research Laboratories, AMC Foreign Science and Technology Center, Yuma Proving Grounds, the US Army Field Artillery School, and Edgewood Arsenal.

NOMENCLATURE

A	projectile reference area, $\pi\ d^2/4$
a	speed of sound
CG	SPIN73 label - center of gravity, calibers from nose
C_ℓ	rolling moment coefficient, $\ell/1/2\rho V^2 Ad$
CLP	SPIN73 label - see Equation 6
C_m	pitching moment coefficient, $m/(1/2\rho V^2 Ad)$
CMA	SPIN73 label - see Equation 3
CMQ	SPIN73 label - see Equation 3
C_N	normal force coefficient, $N/(1/2\rho V^2 A)$
C_n	yawing moment coefficient, $n/(1/2\rho V^2 Ad)$
C'_n	Magnus contribution to C_n
CNA	SPIN73 label - see Equation 2
CNPA	SPIN73 label - see Equation 5
CNPA3	SPIN73 label - see Equation 5
CNPA5	SPIN73 label - see Equation 5
CNPA[5]	SPIN73 label - Magnus moment secant slope per radian at 5° total angle of attack
CPF[1]	SPIN73 label - center of pressure of Magnus force, calibers from nose at 1° total angle of attack
CPF[5]	SPIN73 label - center of pressure of Magnus force, calibers from nose at 5° angle of attack
CPN	SPIN73 label - center of pressure of normal force, calibers from nose
CX	SPIN73 label - zero total angle of attack axial force coefficient, see Equation 1
C_x	axial force coefficient, $X/(1/2\rho V^2 A)$
CX2	SPIN73 label - see Equation 1
CYPA	SPIN73 label - see Equation 4
C_y	Side force coefficient, $Y/(1/2\rho V^2 A)$
C'_y	Magnus contribution to C_y

d	projectile reference diameter
I_A	axial moment of inertia of projectile about axis of symmetry
I_T	transverse moment of inertia of projectile about c.g.
IX	SPIN73 label - I_A
IY	SPIN73 label - I_T
L	projectile over-all length
ℓ	rolling moment
m	pitching moment about c.g
M	Mach number, V/a
N	normal force
n	yawing moment about c.g.
p	spin rate
P	non-dimensional spin rate, pd/2V
q	pitch rate
Q	non-dimensional pitch rate, qd/2V
r	yaw rate
R	non-dimensional yaw rate rd/2V, or range
V	flight velocity
W	projectile weight
X	axial force
Xcg	axial distance from projectile nose to center of gravity, calibers
Y	side force
α	total angle of attack
ρ	air density

TABLE OF CONTENTS

Appendixes

Figures

Figures

INTRODUCTION

This study was undertaken to provide an aeroballistic data base for Project HOWLS (Hostile Weapons Location System), an ARPA initiated task administered by the Lincoln Laboratory of the Massachusetts Institute of Technology. The term aeroballistic here is used in a very broad sense as the study was initially intended to cover both US and USSR projectile characteristics: dimensions and inertial properties, trajectories, zoning, dispersion, and aerodynamic coefficients; control aeroballistics: experimental and analytical status of spinning projectiles with aerodynamic control surfaces (especially canards); present and projected fuze designs; gun launch environments and hardening capabilities (especially sensors); and terminal ballistics and effects: lethality, vulnerability, and sensitivity coefficients.

The tasks discussed above were to have been completed by the end of January 1976 (nine months from the starting date of 1 May). Changes in FY 1976 funding for the entire HOWLS program resulted in Lincoln Laboratory requesting in September that work be halted at that point and that whatever had been accomplished up to that point be reported.

In order to make this report more widely useable, it has been divided into a main report and an addendum. The main report contains no classified information. All of the classified information is in the addendum; this includes some range information on US rounds currently being developed and all of the information on Soviet munitions.

The reprogramming of funds by the HOWLS Project sponsor resulted in funding being directed to other tasks than this one. The effect of this is discussed where appropriate in this report. A useful data base has been created which can be extended to its full capability at a later time.

DISCUSSION

Aeroballistic Characteristics

Weapons and Projectiles

The main published sources of information on US Army weapons in use at the present time and the plans for the future are References 1 and 2. These references should certainly be obtained as part of the overall program.

The indirect fire weapons currently considered to be active (some reserve units and US allies may still be using others) are:

1. 4.2 inch: M30 Mortar

2. 105mm: M101A1 Towed Howitzer, M102 Towed Howitzer (air mobile); M108 Self-Propelled Howitzer (only in some active National Guard and US Army Reserve units)

3. 155mm: M109 Self-Propelled Howitzer (conversion to M109A1 expected to be completed by FY 1976, one-half had been converted as of October 1974), M109A1 Self-Propelled Howitzer, M114A1 Towed Howitzer;

4. 175mm: M107 Self-Propelled Gun (will be phased out when M110E2 is available)

5. 8-inch: M110 Self-Propelled Howitzer.

The future mix of weapons is expected to be:

1. 4.2 inch: M30 Mortar

2. 105mm: XM204 Towed Howitzer

3. 155mm: XM198 Towed Howitzer, M109A1 Self-Propelled Howitzer

4. 8-inch: M110E2 Self-Propelled Howitzer

The various types of indirect fire projectiles currently being used in and supplied to the field for these different weapons systems were determined from a variety of sources. Among these sources were: Department of the Army publications (Ref 3-17), Ammunition Development and Engineering Directorate (ADED) at Picatinny Arsenal, Ballistic Research Laboratories, Edgewood Arsenal, and the US Army Field Artillery School. The results are shown in Table 1.

Table 1

Currently active fielded projectiles (US)[a]

Bore size	Projectile designation	Type
4.2 Inch (Mortar)	M329A1	High Explosive (HE)
	M329A1E1	HE
	M328A1	White Phosphorus (WP)
	M335A1	Illuminator (Illum)
105mm	M1	HE
	M60	Gas
	M60	Smoke
	M60	WP
	M314A2E1	Illum
	M444	Improved Conventional Munition (ICM)
	M548	HE, Rocket Assisted (RA)
155mm	M107	HE
	M110	Gas
	M110	WP
	M121A1	Chemical
	M485E1, E2	Illum
	M449, E1, E2	ICM
	M549	HE, RA
	M454	Atomic
	M483A1	ICM
175mm	M437A1, A2	HE
8-Inch	M106	HE
	M426	Chemical
	M404	ICM
	M422	Atomic
	M424	HES

[a]The corresponding available data for Soviet weapons and projectiles is in Table 1A of the Addendum.

US projectiles not yet released or still under development are listed in Table 2.

Table 2

Projectiles in development (US)

Bore size	Projectile designation	Type
105mm	XM710	ICM
155mm	XM708E2, E3	HE
	XM718/741	AT (antitank)
	XM692/731	AP (antipersonnel)
	XM687	Bulk Cannister
	XM712	Cannon Launched Guided Projectile (CLGP)
8-Inch	XM650E4	HE, RA
	XM711	HE
	XM509	ICM
	XM736	Bulk Cannister
	XM753	Atomic, RA

Projectile Dimensions and Inertial Properties

This section presents the best data currently available. They represent contributions from many sections of Picatinny Arsenal, Ballistic Research Laboratories, Yuma Proving Ground, and Edgewood Arsenal. It must be realized that both production and developmental projectiles change in these characteristics. Many of the fielded and stock-piled projectiles were developed at a time when close attention to shape and inertial properties was not considered necessary and therefore the measurements available are both few in number and old (Ref 18 and 19). Production lots also vary in these characteristics due both to "minor" changes made over the years and changes in the method of manufacture and of manufacturer. The developmental projectiles are exactly that and, hence, are subject to changes in properties during the development cycle. All of this is in addition, in both the above cases, to the normal deviations to be expected from round to round. All values given are the nominal values

With these caveats in mind, the projectile dimensions and inertial properties are given in Table 3 to 7. The properties listed are also defined in Figure 1. The tabulated dimensions are all given in calibers (center of gravity is from the nose, where nose means the tip of the fuze and an exterior length of 3.75 inches was used for the fuze) except for the shell diameter (DIA) which is given in inches. Weight is tabulated in pounds and the moments of inertia are in pounds-inches squared. A few shell which are being or have been deleted from the inventory and, therefore, do not appear in Table 1 are included in these tables to provide a more complete data bank.

The data for Soviet projectiles are presented in Table 2A which is in the classified Addendum to this report.

Zoning

One often hears the nomenclature in this area used loosely and interchangeably. To be exact, a "Charge" is a standardized amount of a particular propellant which produces a desired muzzle velocity for the projectile and weapon under consideration. A "Zone" is the distance on the ground between the range at maximum range quadrant elevation and the range at maximum quadrant elevation for a given charge, projectile, and weapon.

Table 3

Dimensions and inertial properties of 4.2 inch projectiles

PROPERTY*	M329A1 (with/ without extension)	M328A1 (with/ without extension)	M335A1 (with/ without extension)	M329A1E1
LOA, cal	4.80			4.10
OGL	1.85			2.35
BTL	0.0			0.565
XCG (nose)	2.98/2.96		2.91/2.88	2.52
DMP	0.131			0.131
DRB	0.014			
OGR	2.5			5.3
BML	1.35/0.70			0.895
DBA	1.0			0.84
DBM, cal	0.35			0.31
DIA, inches (meters)	4.191 (0.1065)			
IA, $lb\text{-}in^2$ ($kg\text{-}m^2$)	65.5/65.5 (0.0192/0.0192)	67.0/67.0 (0.0196/0.0196)	63.1/67.0 (0.0185/0.0196)	49.0 (0.0143)
IT, $lb\text{-}in^2$ ($kg\text{-}m^2$)	775./749. (0.227/0.217)	826./800. (0.242/0.234)	807./800. (0.236/0.234)	414. (0.121)
WGT, lb (N)	25.7/25.4 (114./113.)	28.0/27.8 (125./124.)	26.7/26.5 (119./118.)	20.6 (91.6)

*See Fig 1 for definitions.

Table 4

Dimensions and inertial properties of 105mm projectiles

PROPERTY*	M1	M60WP	M60 SMOKE	M60 GAS	M84 SMOKE (All)	M314A2E1	M444	M548E1 (Launch/ Burn-Out)	XM710
LOA, cal	4.72				4.53	4.76	4.63	5.22	4.72
OCL	2.58				2.32	1.78	2.37	2.92	2.58
BTL	0.487				0.740	0.00	0.456	0.544	0.487
XCG (nose)	3.01	3.01	3.05		2.83	2.94	2.84	3.28/3.22	2.98
DMP	0.133								0.143
DRB	1.015								
OGR	6.17					3.11	5.33	18.6	6.17
BML	0.00							0.681/0.420 (cap on/ cap off)	0.00
DBA	0.846				0.765	1.00	0.839	0.844	0.846
DBM, cal	0.00							0.317	0.00
DIA, inches (meters)	4.13 (0.1049)								
IA, $lb\text{-}in^2$ ($kg\text{-}m^2$)	79.4 (0.0232)	82.4 (0.0241)	78.1 (0.0229)			87.2 (0.0255)	74.9 (0.0219)	67.6/66.0 (0.0198/0.0193)	73.0 (0.021[illegible])
IT, $lb\text{-}in^2$ ($kg\text{-}m^2$)	762. (0.223)	825. (0.241)	782. (0.229)		639. (0.187)	756. (0.221)	732. (0.214)	846./809. (0.248/0.237)	660. (0.193)
WGT, lb (N)	33.0 (147.)	34.8 (155.)	33.0 (147.)			35.0 (156.)	33.1 (147.)	28.5/27.5 (127./122.)	33.1 (147.)

*See Fig 1 for definitions.

Table 5

Dimensions and inertial properties of 155mm projectiles

PROPERTY*	M107	M110WP	M110 GAS	M116 SMOKE White/Colored	M121, A1	M485E1, E2	M449E1	M449E2	M549 (Launch/ Burn-Out)	M454/455
LOA, cal	4.52								5.65	5.59
CTL	2.44					2.50			3.01	2.09
BTL	0.416					0.488			0.579	0.00
XCG (nose)	2.97		3.03			2.93	2.99	2.78	3.53/3.48	3.59
DMP	0.090									0.132
[illegible]	1.016									
OGR	10.8					11.2			18.9	9.85
BML	0.00									
DBA	0.875					0.854			0.846	1.00
DBM, cal	0.00									
DIA, inches (meters)	6.092 (0.1547)					6.095 (0.1548)			6.092 (0.1547)	
IA, lb-in^2 (kg-m^2)	499. (0.146)	497. (0.145)	491. (0.144)	491./447. (0.144/0.131)	515. (0.151)	487. (0.143)	475. (0.139)	485. (0.142)	506./483. (0.148/0.141)	694.7 (0.2033)
IT, lb-in^2 (kg-m^2)	4311 (1.262)	4481 (1.311)	4424. (1.295)	4424./4024. (1.295/1.178)	4643. (1.359)	3640. (1.065)	3593. (1.051)	3652. (1.069)	6610./6270. (1.934/1.835)	6707. (1.963)
WGT, lb (N)	95.0 (423.)	96.1 (427.)	95.0 (423.)	95.0/86.4 (423./384.)	99.7 (443.)	90.0 (400.)	95.5 (425.)	96.1 (427.)	95.0/89.2 (427./397.)	120.4 (536.)

*See Fig 1 for definitions

Table 5 (contd)

PROPERTY*	M483E1	XM718/741	XM692/731	XM667	XM708E2	XM708E3	XM712 (CLGP) Launch	XM712 (CLGP) Fins Extended	XM712 (CLGP) Fins & Wings
LOA, cal	5.80	→	→	→	5.29	5.65	9.0	→	→
OGL	2.84	→	→	→	3.02	→	1.24	→	→
BTL	0.255	→	→	→	0.593	→	0.00	→	→
XCG (nose)	3.64	3.63	3.69	3.61	3.39	3.52	5.17	5.18	→
DMP	0.098	→	→	→	0.090	→	Nose Rad. 0.27	→	→
DRB	1.016	→	→	→	→	→	1.030	→	→
OGR	9.48	→	→	→	18.9	→	∞ (Conical)	→	→
BML	0.00	→	→	→	→	→	→	→	→
DBA	0.928	→	→	→	0.844	→	1.00	→	→
DBM, cal	0.0	→	→	→	→	→	→	→	→
DIA, inches (meters)	6.095 (0.1548)	→	→	→	6.092 (0.1547)	→	6.000 (0.1524)	→	→
IA, lb-in^2 (kg-m^2)	540. (0.158)	580. (0.170)	540. (0.158)	[illegible] (0.162)	508. (0.149)	517. (0.151)	811. (0.237)	894. (0.262)	917. (0.269)
IT, lb-in^2 (kg-m^2)	5860. (1.715)	5830. (1.706)	5930. (1.735)	6230. (1.823)	4900. (1.405)	6085. (1.781)	27930. (8.173)	28400. (8.311)	28400. (8.311)
WGT, lb (N)	103.0 (458.)	102.0 (454.)	103.5 (460.3)	92.5 (411.)	96.0 (427.)	96.0 (427.)	134.6 (598.7)	→	→

*See Fig 1 for definitions.

Table 6

Dimensions and inertial properties* of 175mm projectiles, M437A1, M437A2

LOA, cal	5.48
OGL	2.93
BTL	1.00
XCG (nose)	3.50
DMP	0.080
DRB	1.032
OGR	25.0
BML	0.00
DBA	0.713
DBM, cal	0.00
DIA, inches (meters)	6.885 (0.1749)
IA, $lb\text{-}in^2$ ($kg\text{-}m^2$)	954. (0.279)
IT, $lb\text{-}in^2$ ($kg\text{-}m^2$)	11800. (3.45)
WGT, lb (N)	147.8 (657.4)

*See Fig 1 for definitions.

Table 7

Dimensions and inertial properties of 8 inch projectiles

PROPERTY*	M106	M426	M404	M422	M424	M509E1	XM736	XM650E4 (Launch-Burn-out)	XM753 (Launch-Burn-out)	XM711
LOA, cal	4.40			4.63		5.49				5.15
OGL	2.27		2.42	1.58		2.49		3.01		
BTL	0.503		0.545	0.00		0.338		0.452		0.473
XCG (nose)	2.83		2.85	3.17	3.21	3.60	3.40	3.56/3.60	3.67/3.61	3.37
DMP	0.069			0.065		0.075		0.069		
DRB	1.018									
OGR	8.01					11.7		20.0		
BML	0.0									
DBA	0.841		0.826	1.00		0.905	0.884			0.878
DBM, cal	0.0									
DIA, inches (meters)	7.990 (0.2029)			7.994 (0.2030)		7.995 (0.2031)		7.990 (0.2029)	7.993 (0.2030)	7.990 (0.2029)
IA, $lb\text{-}in^2$ ($kg\text{-}m^2$)	1913. (0.5306)	1804. (0.5279)	1745. (0.5107)	1729. (0.5060)	1617. (0.4732)	1934. (0.5660)	2116 (0.6192)	1921./1849. (0.5622/0.5411)	1930./1858. (0.5648/0.5438)	1887. (0.5522)
IT, $lb\text{-}in^2$ ($kg\text{-}m^2$)	14500. (4.243)	14430. (4.223)	13310. (3.895)	11880. (3.477)	11700. (3.424)	16020. (4.688)	175[illegible]. (5.12[illegible])	15320./14594. (4.482/4.271)	16000./15281 (4.682/4.472)	16750. (4.902)
WGT, lb (N)	200.0 (889.5)	199.0 (885.2)	200.0 (889.[illegible])	240.0 (1068.[illegible])	243.2 (1082.[illegible])	205.0 (911.9)	206.0 (916.3)	200.0/187.6 (889.6/834.4)	200.0/187.6 (889.6/834.4)	200.3 (891.0)

*See Fig 1 for definitions.

Table 8

Zoning solutions - muzzle velocity (m/s),
4.2-inch mortar, M30

CHARGE* (INCREMENTS)	EXTENSION	M328A1	M335A1	M329A1	M329A2 (M329A1E1)
5	No	109	110	108	NA
10		145	145	144	
15		181	181	180	
20		217	217	216	
25 4/8	No	255	253	256	
25 4/8	Yes	229	230	227	
30		250	251	248	
35		273	274	271	
41	Yes	298	297	299	NA
0	NA	NA	NA	NA	96.9
5					140.6
10					178.5
15					211.6
20					241.3
25					268.5
30					294.4
34	NA	NA	NA	NA	314.9

*M329A2 uses a different set than the others. Not all increments are shown for both sets.

Table 9

Zoning solutions - muzzle velocity (m/s), 105 mm Howitzers [redacted]

CHARGE	WEAPON/SHELL	M1	M60 GAS	M60 SMOKE	M84 (All)	XM710	M444	M60 WP	M314A2E1	M548E1*
1 (M67)	M101A1/A2	195	→	→	→	→	→	177	→	No
	M102	205	→	→	→	→	→	187	→	No
	XM204	204	→	→	→	→	→	186	→	No
2 (M67)	M101A1/A2	212	→	→	→	→		197	→	No
	M102	223	→	→	→	→	→	208	→	No
	XM204	224	→	→	→	→	→	209	→	No
3 (M67)	M101A1/A2	233	→	→	→	→	→	218	→	183
	M102	247	→	→	→	→	→	232	→	195
	XM204	247	→	→	→	→	→	232	→	203
4 (M67)	M101A1/A2	262	→	→	→	→	→	247	→	230
	M102	278	→	→	→	→	→	263	→	245
	XM204	287	→	→	→	→	→	272	→	256
5 (M67)	M101A1/A2	302	→	→	→	→	→	286	→	290
	M102	325	→	→	→	→	→	309	→	308
	XM204	337	→	→	→	→	→	321	→	326
6 (M67)	M101A1/A2	366	→	→	→	→	→	292	→	402
	M102	393	→	→	→	→	→	374	→	429
	XM204	408	→	→	→	→	→	389	→	457
7 (M67)	M101A1/A2	465	→	→	→	→	→	439	→	515
	M102	494	→	→	→	→	→	468	→	549
	XM204	509	→	→	→	→	→	483	→	579
8 (XM200)	No	---						---	→	---
	No	---						---	→	---
	XM204	Addendum	→	→	→	→	→	Addendum		No

* M167 Charge

Table 10

Zoning solutions-muzzle velocity (m/s), 155mm systems

CHARGE	WEAPON/SHELL	M107	M110 GAS	M110 WP	M449E1,E2	XM708E[illegible],E3	XM549	M183A1	XM718 /741	XM692 /731	M485E1,E2	XM687	XM454*
1G (M3A1)	M109 M109A1	207.3 211.8	→	→	208.8 213.3	→	→	197.6 201.8	→	→	212 216	No	
1 (XM164)	M109A1 XM198	223.2	→	→	213.4	→	→	207.3	→	→	228	No	310.9
2G (M3A1)	M109 M109A1	236.2 237.7	→	→	236.2 237.7	→	→	223.4 224.6	→	→	242 244	No	
2 (XM164)	M109A1/ XM198	267.7	→	→	259.1	→	→	253.0	→	→	274	No	374.9
3G (M3A1)	M109 M109A1	275.8 277.4	→	→	274.3 275.9	→	→	263.1 264.6	→	→	283 284	264.9 266.5	
3 (XM164)	M109A1 XM198	288.4	→	→	280.5	→	→	270.1	→	→	295	275.8	550.6
4G (M3A1)	M109 M109A1	317.0 318.5	→	→	315.5 317.0	→	→	303.9 305.4	→	→	325 327	309.8 311.3	
4 (XM164)	M109A1/ XM198	375.0	→	→	368.9	→	→	354.2	→	→	383	364.2	
5G (M3A1)	M109 M109A1	374.9 374.9	→	→	370.3 370.3	→	→	358.6 359.7	→	→	385 385	368.3 368.3	
5 (XM164)	M109A1/ XM198	465.5	→	→	460.4	→	→	441.0	→	→	475	454.8	

*XM72 Charge

Table 10 (contd)

CHARGE	WEAPON/SHELL	M107	M110 GAS	M110 WP	M449E1,E2	XM708E2,E3	XM549	M483A1	XM718 /741	XM692 /731	M485E1,E2	XM687	XM454
3W (M4A2)	M109 M109A1	269.7 292.6	→	→	266.7 289.6	→	→	269.5 292.3	→	→	274. 297.	274.6 297.5	NOT APPLICABLE
4W (M4A2)	M109 M109A1	313.9 336.8	→	→	312.4 335.3	→	→	308.0 330.4	→	→	320. 343.	316.4 339.3	
5W (M4A2)	M109 M109A1	373.4 393.2	→	→	370.3 390.1	→	→	365.3 384.7	→	→	379. 399.	374.2 394.0	
6W (M4A2)	M109 M109A1	461.8 475.5	→	→	461.8 475.5	→	→	447.5 460.9	→	→	471. 484.	459.8 473.5	
6 (XM201E2)	M109A1 XM198	609.8	→	→	603.7	→	→	591.3	→	→	619.	598.7	
7W (M4A2)	M109 M109A1	562.4 565.4	→	→	560.8 571.0	→	→	542.3 545.3	→	→	574. 577.	558.5 561.5	
7 (XM201E2)	M109A1/ XM198	692.1	→	→	684.5	→	→	667.5	→	→	704.	675.4	
8 (M119)	M109 M109A1	No 684.3	→	→	No 675.	→	→	No 668.	→	→	No 696.	No 692.6	
8 (XM203E2)	M109A1/ XM198	No	→	→	826.0	→	→	801.6	→	→	No	No	

Table 11

Zoning solution, muzzle velocities, 175mm system (self-propelled gun, M107, projectile M437A1, A2)

CHARGE	MUZZLE VELOCITY (m/s)
1G (XM124)	510.5
1W (M86A1, A2)	510.5
2W (M86A1, A2)	704.1
3W (M86A1, A2)	914.4

Table 12

Zoning solutions, muzzle velocity (m/s), 8-inch systems

CHARGE	WEAPON/SHELL	M106	M404	M509E1	XM736	(M422/424)	XM650E4	XM711	XM753
1 (M1)	M110 M110E2	249.9 255.5	249.9 255.	240.6 239.	→ →	254.5 260.	247. 244.	→ →	→ →
2 (M1)	M110 M110E2	274.3 280.5	274.3 280.	265.5 264.	→ →	359.7 366.	270. 268.	→ →	→ →
3 (M1)	M110 M110E2	304.8 309.8	304.8 310.	295.4 296.	→ →	547.1 552.	299. 299.	→ →	→ →
4 (M1)	M110 M110E2	350.5 354.0	349.3 353.	338.7 341.	→ →		341. 345.	→ →	→ →
5 (M1)	M110 M110E2	420.6 423.8	418.2 421.	407.3 410.	→ →		405. 415.	→ →	→ →
5 (M2)	M110 M110E2	420.6 446.0	418.2 448.	416.8 439.	→ →		424. 442.	→ →	→ →
6 (M2)	M110 M110E2	499.9 519.8	497.1 522.	492.0 509.	→ →		497. 512.	→ →	→ →
7 (M2)	M110 M110E2	594.4 607.0	591.3 604.	581.0 591.	→ →		588. 602.	→ →	→ →
8 (XM188E2)	M110 M110E2	No 710.4	No 707.	No 694.	→ →		No Addendum	→ →	→ →
9 (XM188E2)	M110 M110E2	No 771.3	No 768.	No 755.	→ →		No Addendum	→ →	→ →

*Propelling charge M80

A Charge is usually also identified by a one or two character alphanumeric code for ease of referencing (firing tables, etc.). Quite often there is more than one type of propellant (the difference can be in either composition or shape or both) used in the same weapon system. These types have an official designation also. For example, the 155mm M109A1 Howitzer currently uses three such propellant types designated as: M3A1, M4A4, and M119. There are five different amounts of the M3A1 propellant used and identified as Charges 1G through 5G; five different amounts of the M4A2 propellant identified as Charges 3W to 7W; and the M119 propellant has one charge, Charge 8.

A zoning solution for a weapon system has as its main goal the assurance of a range over-lap between the zones of adjacent charges or, at the very least, the avoidance of a gap. Quite often practical aeroballistics will also affect these solutions since all shell have some Mach number and quadrant elevation regions where they exhibit lower performance than over most other regions. A judicious selection of launch velocities can often help alleviate the effect of such flight regimes and therefore decrease dispersion and increase effective range.

It can be seen that a zoning solution consists of a set of muzzle velocities which, in turn, determines the charge (type and amount) for a specific weapon and projectile.

These zoning solutions have been tabulated for US weapon systems from the 4.2 inch Mortar to the 8-inch Howitzers in Tables 8 to 12. These are based on References 3 to 17 and data provided by Firing Tables Branch, BRL; Yuma Proving Ground; numerous sections of the Ammunition Development and Engineering Division, Picatinny Arsenal, and Edgewood Arsenal. Note that the 4.2 inch Mortar differs from regular artillery weapons in having only three quadrant elevations and many muzzle velocities (charge increments). Thus, Table 8 has only selected charge increments. If a complete tabulation is needed, they can be found in References 3 and 4. The zoning solutions that are available for Soviet weapon systems are in Table 3A in the classified addendum to this report and so is classified data on US projectiles.

Rocket assisted projectiles (RAPs) require more than their launch velocity to be specified in order to predict their range and, hence, their zones. Therefore, the necessary remaining information beyond that in the inertial properties tables for before and after burning and the aerodynamic coefficients in Appendix B are presented here in Table 13 for US RAPs (insufficient data is available on Soviet RAPs).

Table 13

Rocket assisted projectile thrust data

Projectile	Delay time[a] (sec)	Burn time (sec)	Thrust (lb)	Drag form factor (during burning)
M548	14.	2.3	92.5	1.00
M549	7.	2.5	558.0	1.00
XM650E4	7.	3.0	786.5	0.96
XM753	7.	3.0	786.5	0.96

[a]Time from launch to motor ignition

Zoning information for the XM712 is also available from the trajectory data in that section of this report and in the zoning section of the Addendum.

Dispersion

The US Army has standardized upon the probable error as the measure of dispersion. Range and deflection dispersion are treated as separate one-dimensional problems. Since a probable error in range or deflection is defined as the distance on both sides of the mean point of impact (MPI) which together will include (in a statistical sense) 50% of the rounds fired, a one-dimensional probable error is 0.6745 of the unbiased standard deviation.

These probable errors, range and deflection, are tabulated in References 3 to 17 in their supplementary data tables. They are also shown in the probable error columns in the compacted firing tables in Appendix A of this report.

"Firing table" values are usually the smallest measure of dispersion. Various other measures of dispersion are thoroughly discussed in Reference 1 and the pertinent excerpt is included here verbatim. The only changes have been to include some curves of the "firing table" values (these are labeled "precision" since they conform to that definition in Reference 1) on their graphs and to adjust figure and reference nomenclature.

> "One of the most confusing field artillery performance characteristics is the delivery accuracy. Table 14 lists both the precision and MPI probable errors for conventional and extended range projectiles. Precision is the scatter of burst points about the mean point of impact (MPI) of a group of rounds fired from a single weapon on a single occasion from a single site. The MPI is the mean range and mean deflection of a set of impact points. If the rounds are fuzed for air bursts, the mean burst height is also included. The MPI is not necessarily the aimpoint or target. The probable error in precision is usually expressed in meters (m) measured from the MPI. If, for example, at a certain range 50 percent of the projectiles fall between the mean range plus 10 m and the mean range minus 10 m, the precision probable error in range is 10 m at that specified range. The listed precision errors are given in units of percent range (range at which measurement is valid) and

mils deflection. The values given are average values that may occur between 75 percent of maximum weapon range and maximum range at the top charge. For instance, Table 14 lists 0.21 percent range and 0.65 mils as the precision error for the M101A1 howitzer firing conventional munitions; therefore, the precision probable error in range at maximum range (11.0 km) is 23.1 m and the precision probable error in deflection at the same range is 7.0 m. At 75 percent maximum range (8250 m), the precision probable range and deflection errors are 17.3 and 5.3 m, respectively. The listed precision data are not applicable to ranges less than 75 percent maximum weapon range (precision error vs range is nonlinear) or to charges (zones) other than top charge.

To describe a more realistic delivery accuracy, the mean point of impact (MPI) error is used. The MPI error is defined as the scatter of MPIs about an aimpoint. The aimpoint is not necessarily the target, there may be an unknown target location error. Precision errors are caused primarily by inherent errors in a single weapon and ammunition system, but MPI errors are caused by system errors such as imperfect aiming procedures and erroneous meteorological predictions. In a fire mission adjusted by a forward observer, the primary source of MPI error will be the forward observer's adjustment and location inaccuracies. In the Met + VE predicted fire mission, however, the MPI error will be caused by meteorological errors (Met) and velocity errors (VE) such as tube-to-tube differences (in a battery) and registration errors (a registration is never truly accurate, but it is assumed to be so; therefore, there is a constant residual error for each registration). The largest meteorological error results from the inability to satisfactorily predict wind velocity and direction. This ballistic wind error may be 150 percent larger than any other single met error. Available Met + MPI probable errors are given in Table 14 in units of percent range and mils deflection. As before, these are average values that may occur between 75 percent of maximum weapon range and maximum range at top charge.

Figures 2 through 7 graphically describe the range and deflection MPI probable error (in metres) as a function of range for selected weapons firing Met + VE missions. In

Table 14

Field artillery cannon-type weapon systems

Weapon system	Precision probable error Range/Deflection Conventional	Precision probable error Range/Deflection Extended range	MPI probable error Range/Deflection Conventional	MPI probable error Range/Deflection Extended range	Cannon designation
M101A1	0.21/0.65		0.93/3.[illegible]		M2A1/A2
M102	0.16/0.27				M13[illegible]A1
XM204	0.25/1.00	0.25/1.00*			XM205
M108	0.16/0.27				M103
M114A1	0.37/0.32				M1/A1
XM198	0.30/1.00				XM199
M109	0.29/0.39	0.29/0.62	0.73/3.39	0.75/2.75	M126/A1
M109A1	0.33/0.60		0.74/3.37		M185
M110	0.30/0.20		0.72/3.33		M2A2
M110E2	0.25/1.00	0.25/1.00*			XM201
M107	0.28/0.57		0.71/3.62		M113/A1

*as per material need requirement

most illustrations several zones are represented and identified by; for example, I (Charge 1), II (Charge 2), and IIIw (Charge 3, white bag). Several features of this series of figures are outstanding. First, although low charges are designed for short-range operation, at certain ranges the low-charge error is nearly double that of the top zone at the same range. A principal cause of this phenomenon is projectile instability due to slower launch velocities. Cannon life expectancy is advantageously extended, however, when lower charges are used. Figures 3 and 4 show that the M109 firing the M549 RA projectile has a smaller MPI range error than the M109 firing the M107 HE projectile at ranges above 8 km with Charge 7. At 12 km, the M109/M549 RA has an MPI range probable error at 74 m; the M109/M107 HE, 90 m. These values seem illogically reversed. One possible reason for this unexpected result may be that the RAP is less sensitive to ballistic winds because of the inherent in-flight propulsion and improved aerodynamics. Figure 7, the MPI probable error of the M107 175mm gun, shows the error magnitude that may be expected for 30-km systems: range probable error, 20m; deflection probable error, 110 m. This is not the end of the delivery accuracy story, however, as best shown by the Helbat I tests (Ref 20) where simulated operational readiness tests produced some errors greatly in excess of those given by the MPI curves: for an M109 howitzer firing to an average range of 9.0 km, graphical range probable error was 135 m and deflection probable error was 86 m. The MPI probable errors for the same range and zone are as follows: range probable error, 85 m; deflection probable error, 23 m. Since the Helbat ranges varied from 8 to 12 km and since all Helbat missions were not strictly Met + VE types, a direct comparison of the Helbat I data with the MPI error curves may be questionable: but the effect of human error obviously should not be ignored". . .

Further discussion of this topic may be found in Reference 21.

For any case in Appendix A where the source is not a firing table and probable errors are given, they are either from a limited number of firings or estimated from computer simulations. These values should be considered as estimates only. It is worthwhile to repeat the warning in

the discussion from Reference 1 about the dominant effect of meteorological error, primarily winds at altitudes, upon precision and the importance of target location error upon actual miss distances.

The only guided projectile considered in this study is the XM712 (Cannon Launched Guided Projectile (CLGP). The discussion of its accuracy is given in the classified Addendum of this report. Dispersion data on Soviet munitions which is available is also included in the classified Addendum to this report.

Aerodynamic Coefficients

All of the aerodynamic coefficients presented in this report, except for the XM712 (CLGP), were estimated by the same method and are presented in the same format. The method used is documented in Reference 22 and is available as a computer program, SPIN73, in FORTRAN. It consists, basically, of empirical curve fits to a large data base of the effect of various projectile dimensions upon the aerodynamic coefficients (Ref 22).

The estimates generated by SPIN73 are given in Appendix B, except for the data on Soviet ammunition which is in the classified Addendum. Some discussion of the meaning of the various column headings is necessary to understand how to use the output in standard aerodynamic coefficient form.

If we call the total angle of attack α (radians), the spin p (radians/sec), and the angular rates are pitch, q, or yaw, r (both rad/sec), then the various coefficients are, in terms of the SPIN73 tabulated names, as a function of Mach number:

Axial Force: $C_x(M,\alpha) = CX + CX2 \sin^2\alpha$ (1)

Normal Force: $C_N(M,\alpha) = CNA \sin\alpha$ (2)

Pitching Moment: $C_m(M,\alpha,q) = CMA \sin\alpha + (qd/2V)CMQ$ (3)

Magnus Force*: $C'_y(M,\alpha,p) = (pd/2V)CYPA \sin\alpha$ (4)

Magnus Moment*: $C'_n(M,\alpha,p) = (pd/2V)(CNPA \sin\alpha + CNPA3 \sin^3\alpha + CNPA5 \sin^5\alpha)$ (5)

Rolling Moment: $C_\ell(M,p) = (pd/2V)\ CLP$ (6)

*Primes indicate that this is only the Magnus contribution to the side force, C_y and the side moment, C_n.

where all tabulated coefficients are functions of Mach number (M), d is the reference diameter, and V is the flight velocity.

In addition to the above, the following are also tabulated: the normal force center of pressure, CPN (in calibers from the nose), the Magnus force center of pressure at 1° and 5° angle of attack, CPF [1] and CPF [5] (from the nose) and the secant slope of the Magnus moment (per radian) at 5° angle of attack, CNPA [5]. Note that the designation, dimensions, and physical properties of the projectiles are included in the description above the coefficient tables.

The SPIN73 generated coefficients have not been checked for a trajectory match with firing tables, where available, because of the lack of time; therefore, they have not been perturbed to produce such a match. Based on past experience and the degree of coefficient match reported in Reference 22, it is expected that the mismatch is not severe for projectile configurations within the range of the data base.

The XM712 (CLGP) coefficients are presented in whatever form that they were available in the references. Usually derivatives with respect to angle of attack given in this data will be per radian rather than in terms of sin α. The Advanced Development (AD) configuration had only a folding deflectable cruciform tail and is reported in Reference 23. The Engineering Development configuration added a cruciform set of fixed (in deflection) folding wings and this is reported in Reference 24. Edited excerpts taken from these sources are presented in Appendixes C-1 and C-2.

Trajectories and Firing Tables

Complete computer simulated trajectories based on the aerodynamic coefficients in Appendix B and the inertial properties discussed earlier are not available. At the time the termination of this task due to reprogramming of funds became known, it was decided that a thorough job of generating aerodynamic coefficients and collecting inertial properties on the projectiles was necessary, since it would be impossible to compute trajectories at a later date without this data.

Substantial trajectory data are available in this report. The compacted firing tables of Appendix A have range, deflection (angular), and quadrant elevation information. Most of this is from firing tables (Ref 3-17) while some is from computer simulated trajectories available for projectiles in development under other projects or from a limited number of firings. It

is not claimed that this data can be exactly duplicated using the aerodynamic, inertial, and initial conditions data in this report. Based on past experience with SPIN73 aerodynamic coefficients, the results should be in fairly good agreement. Not only is it possible to refer to References 3 to 17 for finer detail in range than is in the compacted tables of Appendix A but these references contain other information that is not in the compacted tables. Probably the most useful of this additional information is time of flight, angle of fall, terminal velocity, and graphs of altitude versus range. However, this data is only available for projectiles which have final or provisional firing tables.

The range data on the XM712 CLGP available in Reference 24 is included in the Fly Under-Fly Out (FUFO) capability (Fig 8-15). This is purely analytical data. More information is available in the Addendum under zoning.

Similar compacted firing tables for those Soviet shell for which full tables are available have been generated and are in the Addendum to this report.

Control Aeroballistics

The subject of this section is the experimental and analytical investigation of the aerodynamics of projectiles guided by aerodynamic surfaces. The primary method of presenting the information will be bibliographies of experimental and analytical methods. There is, of course, some overlap. Analytical reports will usually contain experimental comparisons and experimental reports will often discuss and compare various theories with the data.

There has been some aerodynamic coefficient data on the XM712 Cannon Launched Guided Projectile collected and presented in Appendixes C-1 (AD) and C-2 (ED). They represent both its AD (tail alone) and its ED (tail and wings) configurations and were taken from Control Aerodynamics Experimental Bibliography items CE1 and CE7. Data on a canard controlled-fixed tail CLGP design that was not selected for Engineering Development is available in Experimental Bibliography items CE14, CE15, and CE19.

The bibliographies are not meant to be exhaustive or deal with basic aerodynamics. Hopefully the most recent and/or applicable work on aerodynamic controlled and guided projectiles have been included. It should

be noted that many of the items listed are titles obtained from a computer search and have not yet been obtained for a more complete study of their applicability.

The analytical methods that could be studied exhibit some areas of poor agreement with experimental results. They also usually do not allow for more than two surfaces at a particular body station. Multiple surface capability is needed for all foreseeable artillery rounds. A typical difficulty with the vortex shedding approach, so widely used, is that for in-line surfaces (e.g., wing-tail, canard-tail or canard-wing) the vortex shed by the forward surface may be predicted to pass above (under) the rearward surface while experiment shows it passes under (above) the surface (see discussion in CA10). Other experimental results indicate difficulty in predicting cross-coupling and roll (spin) effects in general and also static stability in the transonic velocity flight regime.

As part of another task, preliminary and final aero data package experimental programs were suggested for the two configurations proposed for the CLGP ED program. These experimental efforts were intended to investigate the expected trouble areas in both cases without incurring excessive program costs; a research program would be more extensive. These programs are attached as Appendixes D-1 and D-2. Appendix D-1 applies to a canard-controlled fixed-tail configuration and Appendix D-2 applies to a fixed-wing tail-controlled configuration.

Analytical studies should be pursued to improve techniques especially for in-line surfaces, transonic flight, multiple surfaces; and pitch, yaw, and roll coupling.

Terminal Ballistics

Lethality and Vulnerability

The lethality and vulnerability aspects of terminal ballistics was intended to be dealt with by a selected bibliography from the basic source, Reference 25. The fact that the selection must be based upon the descriptions in Reference 25 rather than upon actual study of the possible selections is unfortunate.

The descriptions in Reference 25 are sufficiently clear so that the bibliography for this section includes the most useful material currently available. Vulnerability of target systems has been included as an aspect of lethality.

Sensitivity Coefficients

Sensitivity coefficients are, in general, first partial derivatives. For example, holding all other variables constant, the effect of projectile weight on range is linearized as $\Delta R = (\frac{\partial R}{\partial W})\ \Delta W$, where $\frac{\partial R}{\partial W}$ is the sensitivity coefficient for range with respect to weight.

The practice of the US Army is to include such corrections in their firing tables for muzzle velocity, cross wind, range wind, air temperature, air density, and projectile weight. Propellant temperature corrections are also made indirectly. There is usually a separate table which gives the change in muzzle velocity for a given propellant temperature; this is then used as a muzzle velocity correction to range.

The only listed correction which is not a true partial derivative is the one for projectile weight. This range correction includes both the effect of changed muzzle velocity and the effect of changed ballistic coefficient, (W/CxA), during flight. This is why a separate correction for muzzle velocity should not be made for a weight variation. The muzzle velocity correction is to be used for propellant temperature corrections, as mentioned, and for other effects, such as bore wear.

Firing table corrections may appear to be backwards but this is not so. An increase in muzzle velocity will, for example, increase range; that is, $\frac{\partial R}{\partial V} > 0$. But when one looks at a firing table it will be seen that for a muzzle velocity increase (usually tabulated for 1 m/s) the range correction is given as a negative number, a decrease. This is because the tabulated range change is to be algebraically added to the range desired, producing in this case a shorter range. This will require that the gun elevation be set so as to produce this shorter range. Then, when the shell really flies further because of the increase in muzzle velocity, the desired range will be reached. Similar reasoning applies to all the other corrections and is the only real difference between corrections and sensitivity coefficients. (A tail range wind is considered an increase and azimuth corrections for a cross wind are made into the wind.)

Most US Army firing tables give ranges and range corrections in meters and elevations and azimuths and their corrections in mils. One Army mil is defined as 1/6400 of a circle. The usual increments in the independent variables used are: cross and range winds: 1 knot, muzzle velocity: 1 m/s, air temperature: 1% of standard (518.7°R, 288.15°K), air

density: 1% of standard (0.002378 slug/ft^3, 1.2250 kg/m^3), and projectile weight: usually 1 square (SQ) from a stated standard, e.g., 2 SQ STD. Atomic rounds are marked with their actual numerical weight so their firing table corrections are given per pound.

A further explanation of weight squares follows. Artillery projectiles are stamped with square-shaped marks to give an indication of how far away the loaded projectile is from some reference weight. The value of a square is different in terms of pounds from one projectile to another. The approximate values for some projectiles are listed below (Table 15) so that a conversion can be made between squares and pounds. Another point to be kept in mind is that a particular firing table may use a non-zero number of squares as the reference weight of a projectile (the one for which the basic table has been constructed). This is always given but note must be taken. For example: a projectile is stamped with 4 squares but the standard number of squares is given as 2. Therefore, the range correction to be made is that for + 2 squares not that for + 4 squares.

The compacted firing tables presented for US projectiles in Appendix A contain all the corrections mentioned above where they are available. The data on those projectiles which have official firing tables or provisional firing tables are usually complete. Whatever data was available from other projects has been incorporated into Appendix A. Most of the data, especially on projectiles in development, is based on computer simulations but a limited amount of firing data is also available and has been included. Appendix A is no exception to all the data in this report; whenever a projectile datum has been extrapolated unduly or assumed the same as some other projectile, that value is inclosed in parentheses.

Similar compacted firing tables for those Soviet projectiles for which the information exists are presented in the Addendum to this report.

Table 15

Approximate relationship between squares and weight

Projectile	Standard squares	Pounds/square	Source
M329A1	2	0.25	Ref 3
M328A1	2 (= 7 of M329A1)	0.30	Ref 3
M1	2	0.6	Ref 5
M60, Gas	2	0.6	Ref 5
M60, WP	5	1.0	Ref 5
M548	2	0.5	Ref 6
M107	4	1.1	Ref 8
M110, Gas	4	1.1	Ref 8
M110, WP	5	1.1	Ref 8
M116	4	1.1	Ref 8
M116, Colored	(= 4 of M1)	---	Ref 8
M121, A1	8	1.1	Ref 8
M549	4	1.4	Ref 13
M437A1, A2	3	1.1	Ref 14
M106	4	2.5	Ref 15
M404	4	2.5	Ref 17

CONCLUSIONS AND RECOMMENDATIONS

The most up-to-date unclassified aeroballistic data available on US Army indirect-fire projectiles (105mm and up) has been collected or generated. Aeroballistic is used in a very broad sense to include: external dimensions, inertial properties, trajectories, zoning, dispersion, sensitivity coefficients, aerodynamic coefficients, lethality and vulnerability, and controlled projectile aerodynamics.

Classified data in the above areas on US projectiles and all data on Soviet and Soviet Bloc indirect fire artillery projectiles (100mm and up) which were also collected or generated are in a separate addendum to this main report.

This study concentrated on generating a complete set of aerodynamic data without any trajectory information; the rationale being that trajectories can be run later with the data. It is not presently known how closely the aerodynamic data, when used in simulated trajectories, will match firing table results. Past experience lends credence to the belief that the match will be acceptable.

It is recommended that further work in this area should assure consistency between predicted aerodynamic coefficients and firing table results and include free-flight rocket aeroballistics.

REFERENCES

1. Reichard, B. L. and Downs, A. R., *A Compendium of Field Artillery Facts*, BRL Report No. 1759, USA Ballistic Research Laboratories, February 1975

2. Reichard, B. L. and Downs, A. R., *A Compendium of Classified Field Artillery Facts (U)*, BRL Report No. 1760, USA Ballistic Research Laboratories, February 1975, Secret

3. *Firing Tables, Mortar 4.2-Inch: M30 Firing Cartridge, H.E., M329A1 . . .*, Headquarters, Department of the Army, FT 4.2-H-2, August 1968

4. *Firing Tables, Mortar 4.2-Inch, M30, Firing Cartridge, H.E., M329A1E1 . . .*, Headquarters, Department of the Army, FT 4.2-K-1, August 1974

5. *Firing Tables, Cannon, 105mm Howitzer: M2A2 and M2A1 on Howitzer; Light, Towed: 105mm M101A1 and M101 . . ., Firing Cartridge, H.E., M1 . . .*, Headquarters, Department of the Army, FT 105-H-7, May 1971

6. *Firing Tables, Cannon, 105mm Howitzer M103, on Howitzer, Light, Self-Propelled, 105mm, M108 and Cannon, 105mm M137A1 and M137 on Howitzer, Light, Towed, 105mm, M102 Firing Cartridge, H.E., RA, M548*, Ballistic Research Laboratories, Ft 105-AU-1, October 1974

7. *Firing Table Addendum to FT 105-H-6 for Cartridge, H.E., M444*, Headquarters, Department of the Army, FT 105 ADD-B-1, C-4, January 1968

8. *Firing Tables, Cannon, 155mm Howitzer, M126 and M126E1 on Howitzer, Medium, Self-Propelled, 155mm, M109 Firing Projectile, H.E., M107*, Headquarters, Department of the Army, FT 155-AH-3, August 1974

9. *Firing Tables, Cannon, 155mm Howitzer, M185 on Howitzer, Medium Self-Propelled, 155mm M109A1 . . . Firing Projectile, H.E., M107*, Headquarters, Department of the Army, FT 155-AM-1, September 1972

10. *Firing Tables, Cannon, 155mm Howitzer, M126E1 and M126 on Howitzer, Medium, Self-Propelled: 155mm, M109 Firing Projectile, Atomic, XM454,* Headquarters, Department of the Army, FT 155-AJ-2, May 1969

11. *Firing Tables Addendum to FT 155-AH-2 for Projectile, H.E. M339A1 (M449E2),* Headquarters, Department of the Army, FT 155-ADD-B-1, November 1967

12. *Firing Table Addendum to FT 155-Q-3 for Projectile, H.E., M449,* Headquarters Department of the Army, FT 155 ADD-A-1, C-5, January 1968

13. *Provisional Firing Tables, Cannon, 155mm Howitzer, M126E1 and M126 on Howitzer, Medium, Self-Propelled 155mm, M109 Firing Projectile, H.E., RA, M549,* Ballistic Research Laboratories, October 1974

14. *Firing Tables, Cannon, 175mm Gun, M113, M113E1 on Gun, Field Artillery, Self-Propelled: 175mm, M107 Firing Projectile, H.E., M437A2, M437A1,* Headquarters, Department of the Army, January 1970

15. *Firing Tables, Cannon, 8-Inch Howitzer: . . . M2A1E1 on Howitzer, Heavy, Self-Propelled: 8-Inch, M110 Firing Projectile, H.E., M106,* Headquarters, Department of the Army, FT 8-J-4, June 1967

16. *Firing Tables, Cannon, 8-Inch Howitzer . . . M2A1E1 on Howitzer, Heavy, Self-Propelled: 8-Inch, M110 Firing Projectile, HES, M424 Projectile, Atomic, M422,* Headquarters, Department of the Army, FT 80-4, June 1967

17. *Firing Table Addendum to FT 8-J-4 for Projectile, H.E., M404,* Headquarters, Department of the Army, FT 8 ADD-A-1, November 1967

18. Hitchcock, H.P., *Aerodynamic Data for Spinning Projectiles,* Ballistic Research Laboratories, Report No. 620. October 1947

19. *Artillery Ammunition: Guns, Howitzer, Mortars and Recoilless Rifles,* Headquarters, Department of the Army, TM 9-1300-203, April 1967

20. Horley, G. and Giordano, D., *HELBAT I (Human Engineering Laboratory Battalion Artillery Test)*, USAHEL TM-24-70, September 1970

21. *Indirect Fire Accuracy (U)*, 3 Vol., JMEM 61S1-3-6-23, 28 June 1974, Confidential

22. Whyte, R. H., *SPIN-73, An Updated Version of the Spinner Computer Program*, Picatinny Arsenal TR 4588, November 1973

23. *Addendum to Cannon Launched Guided Projectile Advanced Development Program - Final Report (U)*, Martin Marietta Corp., Orlando Division, OR 13, 759-Addendum 1, September 1975, Confidential

24. *CLGP (XM712) Cannon Launched Guided Projectile (U)*, Martin Marietta Corp., Orlando Division, OR 13, 651P, Vol. II: Technical, 14 April 1975, Confidential

25. *Index, Specialized Technical Handbooks for Joint Munitions Effectiveness Manuals (JMEM) and Related Publications*, US Army Materiel Command, AMCRD-TE, TH 61-1-2, 18 June 1975

BIBLIOGRAPHIES

1. Control Aerodynamics Analytical Bibliography

CA1. *The Aerodynamic Analysis of the Coning Motion of the CLGP,* Martin Marietta Corp., Orlando Division, Doc. No. ANA 00900000-002, 13 July 1973

CA2. *Aerodynamic Effect of CLGP Fin Sweep-back Angle Variation,* Martin Marietta, Orlando Division, Doc No. ANA 40700000-010, 6 July 1972

CA3. *Aerodynamic Methodology. Bodies with Tails at Arbitrary Roll Angle,* Fidler, J. E., Martin Marietta, Orlando Division, OR 13,375-1, December 1974 (prepared for Army Missile Command AD/A-003 341)

CA4. *A Method for Calculating the Aerodynamic Loading on Wing-Body Combinations at Small Angles of Attack in Supersonic Flow,* Jackson, C. M. and Sawyer, W. C., NASA TN D-6441, October 1971

CA5. *A Method for Estimating Static Aerodynamic Characteristics for Slender Bodies of Circular and Noncircular Cross Section Alone and with Lifting Surfaces at Angles of Attack from 0° to 90°,* Jorgensen, L. H., NASA TN D-7228, April 1973

CA6. *Analytical Prediction of the Roll/Pitch and Roll/Yaw Coupling of the CLGP Missile,* Martin Marietta Corp., Orlando Division, Doc. No. ANA 00900000-003, 10 August 1973

CA7. *Baseline IV Final Aerodynamics,* Martin Marietta Corp., Orlando Division, Doc. No. ANA 40700000-012, 7 February 1973

CA8. *Cannon Launched Guided Projectile Aerodynamic Configuration Design Study,* Fidler, J. E. and West, K. O., Martin Marietta Corp., Orlando Division, OR 12,879, Vol I, December 1973 (prepared for Naval Ordnance Systems Command)

CA9. *Computer Programs for Calculating the Static Longitudinal Aerodynamic Characteristics of Wing-Body-Tail Configurations,* Mendenhall, M. R., et al, NASA CR-2474, Nielsen Engineering & Research Inc., January 1975

CA10. *Effect of Symmetrical Vortex Shedding on the Longitudinal Aerodynamic Characteristics of Wing-Body-Tail Combination*, Mendenhall, M. R., and Nielsen, J. N., NASA CR-2473, Nielsen Engineering & Research, Inc., January 1975

CA11. *Effects of the Forward Strakes on CLGP Coning Motion*, Martin Marietta Corp., Orlando Division, Doc, No. ANA 00900000-004, 13 August 1973

CA12. *Estimated Aerodynamic Characteristics for the Baseline CLGP Configuration*, Martin Marietta Corp., Orlando Division, Doc, No. ANA 10700000-001, 3 April 1972

CA13. *Estimated Aerodynamic Characteristics for Nine CLGP Configurations*, Martin Marietta Orlando Division, Doc. No. ANA 10700000-02, 13 April 1972

CA14. *Estimated Aerodynamics for the Baseline III CLGP Configuration*, Martin Marietta, Orlando Division, Doc. No. ANA 10700000-007, 8 May 1972

CA15. *Estimation of the Zero-lift Drag of Missile Configurations in Supersonic Flow with Turbulent Boundary Layer*, Jackson, C. M., et al, NASA TM X-1890, 1969

CA16. *Lift and Center of Pressure of Wing-Body-Tail Combinations at Subsonic, Transonic, and Supersonic Speeds*, Pitts, W. C., et al. NACA Report No. 1307, 1957

CA17. *Method for Calculating Induced Rolling Moments for Cruciform Canard Missiles at Angles of Attack up to 20 Deg*, Hemsch, M. J., et al, Naval Weapons Center, NWCTP 5761, May 1975

CA18. *Numerical Methods for the Design and Analysis of Wings at Supersonic Speeds*, Carlson, H. W., and Miller, D. S., NASA TN D-7713, December 1974

2. Control Aerodynamics Experimental Bibliography

CE1. Addendum to *Cannon Launched Guided Projectile Advanced Development Program - Final Report*, (U), Martin Marietta Corp., Orlando Division, OR 13,759 - Addendum 1, September 1975, Confidential

CE2. *Aerodynamic Characteristics of a Canard-Control Modular Weapon Classification at Transonic Mach Numbers,* Kaupp, H., Jr., Arnold Engineering Development Center, AAEDC-TR-73-134, for Air Force Armaments Laboratory, August 1973

CE3. *An Experimental Investigation of the Aerodynamic Characteristics of Several Nose-Mounted Canard Configurations at Supersonic Mach Number,* Burt, J. R., Jr., US Army Missile Command Tech Report P-D-75-17, 30 January 1975

CE4. *An Experimental Investigation of the Aerodynamic Characteristics of Several Nose-Mounted Canard Configurations at Transonic Mach Numbers,* Burt, J. R., Jr., US Army Missile Command, Tech Report P-D-75-2, 30 August 1974

CE5. *Best Estimated Values of CL_{Trim} and δ_{Trim} Based on Wind Tunnel Data,* Martin Marietta Corp., Orlando Division, Doc. No. ANA 00900000-005, 15 August 1973

CE6. *Canard Control Effectiveness Study on the Air Force Advanced Tactical Rocket at Mach Numbers 2, 3, 4, and 5,* Strike, W. T., Jr., Arnold Engineering Development Center, AEDC-TR-74-34, for Air Force Armaments Laboratory, April 1974

CE7. *Cannon Launched Guided Projectile (U),* Martin Marietta Corp., Orlando Division, OR 13,651P, Vol. II: Technical, 14 April 1975, Confidential

CE8. *CLGP Wind Tunnel Test Plans and Post-Test Report,* Martin Marietta Corp., Orlando Division, Doc. No. ANA 10700000-008, 16 June 1972

CE9. *Effect of Several Canard Sizes on the Static Stability, Performance, and Trim Characteristics of the PAVESTORM I Munition System at Transonic Speeds,* Smith, D. K., Arnold Engineering Development Center, AEDC-TR-72-67, for Air Force Armaments Laboratory, May 1972

CE10. *Effects of Nose Bluntness on Aerodynamic Characteristics of Cruciform - Finned Missile Configuration at Mach 1.50 to 2.86,* Jernell, L. S., NASA TM X-2031, June 1970

CE11. *Effect of Wing Planform and Canard Location and Geometry on the Longitudinal Aerodynamic Characteristics of a Close-Coupled Canard-Wing Model at Subsonic Speeds*, Gloss, B. B., NASA TN D-7910, June 1975

CE12. *Elimination of the Induced Roll of a Canard Control Configuration by Use of a Freely Spinning Tail (U)*, Darlington, J. A., Naval Ordnance Laboratory, NOLTR-72-197, August 1972, Confidential

CE13. *Preliminary Static and Magnus Measurements on a Proposed Canard-Controlled Guided Projectile*, Regan, F. J., Naval Ordnance Laboratory Wind Tunnel Report No. 80, April 1974

CE14. *Static Force Test on a 0.7 Scale Cannon Launched Guided Projectile at the VAC High Speed Wind Tunnel in the Mach Range of 0.6 to 2.5*, Box, D. M., Vought Systems Division Report No. HSWT Test 438 (for Texas Instruments, Inc.), June 1972

CE15. *Static Force Test on a 0.7 Scale Cannon Launched Guided Projectile at the VAC High Speed Wind Tunnel in the Mach Range of 0.6 to 2.5-Second Series*, Box, D. M., Vought Systems Division Report No. HSWT Test 446 (for Texas Instruments, Inc.), 19 September 1972

CE16. *Static Stability and Canard Hinge-Moment Characteristics of the AIM-9J (Side Winder) Missile at Mach Numbers from 0.4 to 3.4 (U)*, Arnold Engineering Development Center, AEDC-TR-72-34, Final Report 11 October - 12 November 1971

CE17. *Supersonic Interference Effects in Low-Aspect-Ratio Planer Configurations at Large Angles of Attack*, Hart, H. H., Applied Physics Laboratory, Johns Hopkins University, TG-998, July 1968

CE18. *VSD High Speed Wind Tunnel Force Test on a 0.70 Scale 155mm Cannon Launched Guided Projectile in the Mach Number Range of 0.6 to 2.2*, Pope, T. C., Vought Systems Division Report No. HSWT Test 487 (for Texas Instruments, Inc.), 25 March 1974

3. Lethality and Vulnerability Bibliography

(Index: Specialized Technical Handbooks for Joint Munitions Effectiveness Manuals (JMEM), TH 61-1-2, 18 June 1975)

LV1. 61A1-3-1 Target Vulnerability (U), Secret, 13 Feb 74.

LV2.	61JTCG/ME-69-1	Target Vulnerability Scaling and Modeling, 31 Jan 74
LV3.	61JTCG/ME-69-2	Target Vulnerability Symposium (U), Secret, 15 Apr 69
LV4.	61JTCG/ME-69-3-2	Lethality of US Ammunition Against Soviet Armored Vehicles (U), Secret, 1 Jan 70
LV5.	61JCTG/ME-69-3-10	Blast Effects on Soviet Vehicles (U), Secret, 12 Mar 71
LV6.	61JTCG/ME-69-3-11	Vulnerability of Selected Soviet HE Projectiles to Fragment Impact (U), Confidential, 14 Aug 71
LV7.	61JTCG/ME-70-6-1	JMEM Computer Program for General Full Spray Personnel Mean Area of Effectiveness Computations (U), Confidential, 25 May 71
LV8.	61JTCG/ME-70-6-2	JMEM Computer Program for General Full Spray Personnel Mean Area of Effectiveness Computations (U), Secret
LV9.	61JTCG/ME-73-6	Lethality Predictions for US Army Munitions Tested in Various Environments in the Dep Static Arrays (U), Confidential, 25 Apr 73
LV10.	61JTCG/ME-75-9	Effectiveness Distribution for US Army Improved Conventional Munitions, Confidential
LV11.	61S1-2-2	Effectiveness Data for Howitzer, 105MM M101A1 (U), Confidential, 11 Dec 72
LV12.	61S1-2-3	Effectiveness Data for Howitzer, 155MM, M109 (U), Confidential, 11 Dec 72
LV13.	61S1-2-4	Effectiveness Data for Howitzer, 8-Inch M110 (U), Confidential, 18 Dec 72
LV14.	61S1-2-5	Effectiveness Data for Gun, 175MM M107 (U), Confidential, 18 Dec 72
LV15.	61S1-2-6	Effectiveness Data for Mortar, 4.2 Inch M30 (U), Confidential, 15 May 72
LV16.	61S1-2-8	Effectiveness Data for Rocket, 762MM M50 (U), Confidential, 31 Oct 72
LV17.	61S1-2-13	Effectiveness Data for 155MM Howitzer M109A1 (U), Confidential

LV18. 61S1-3-2	Safe Distances for Fragmenting Munitions (U), Confidential, 19 Mar 73
LV19. 61S1-3-3	Lethal Areas of Selected US Army, US Navy, and US Marine Corps Surface-to-Surface Weapons Against Personnel and Military Targets (U), Confidential
LV20. 61S1-3-4	Manual of Fragmentation Data (U), Confidential
LV21. 61S1-3-5	Ammunition Reliability Report (U), 15 Oct 75

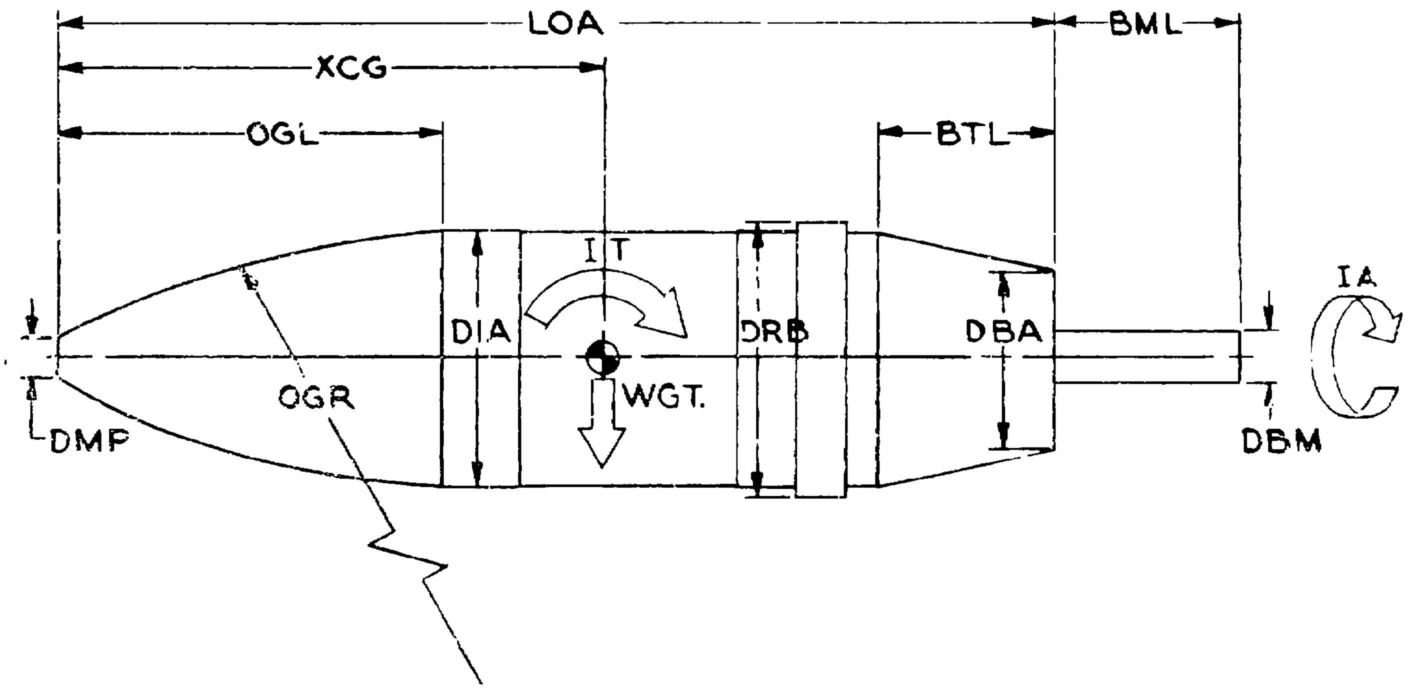


Fig 1. Definition of quantities describing projectile geometry and inertial properties

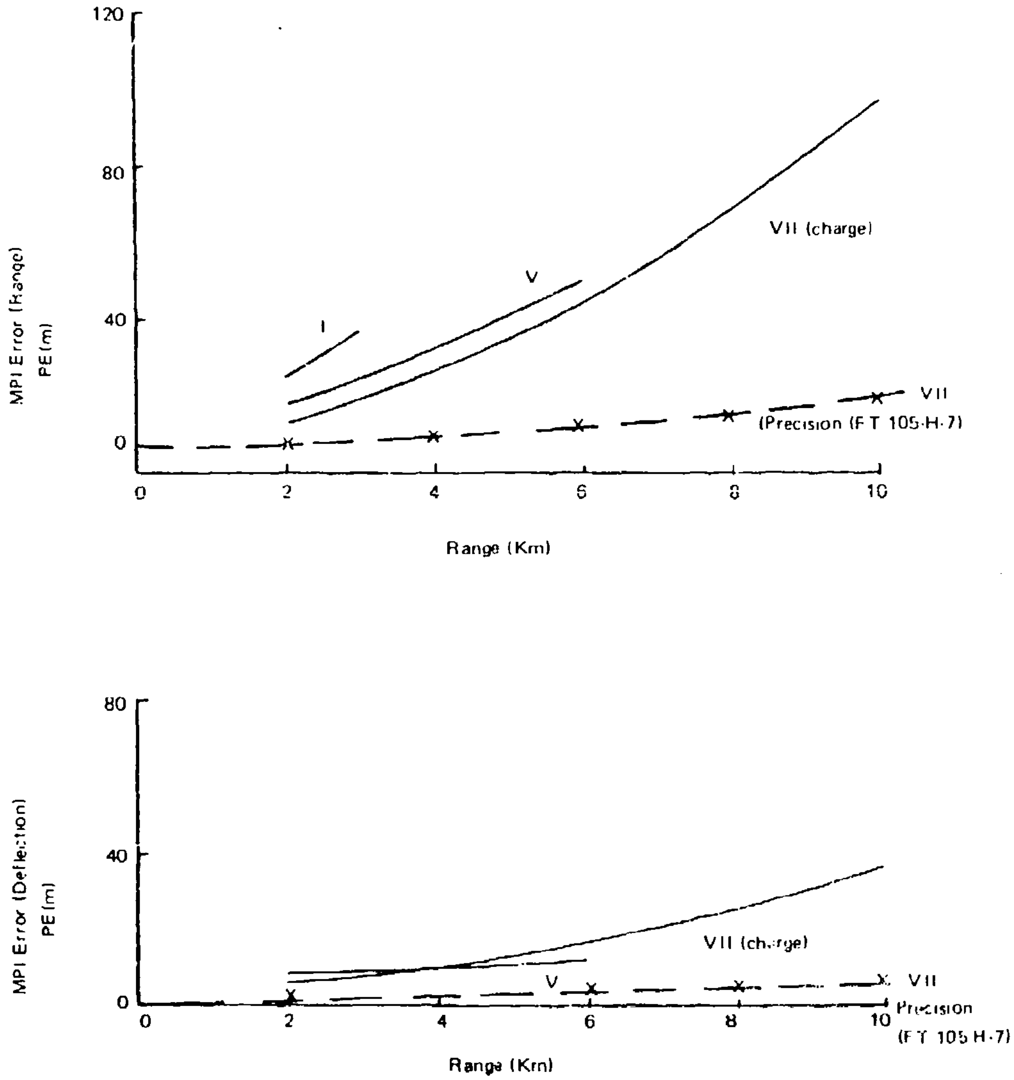
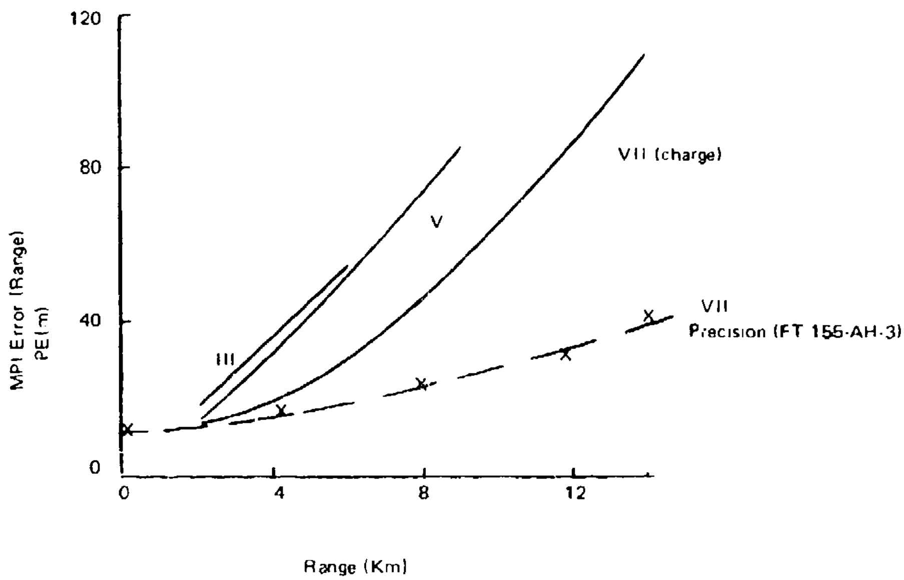


Fig 2. M101A1 (105mm) MPI probable error firing M1 HE projectile



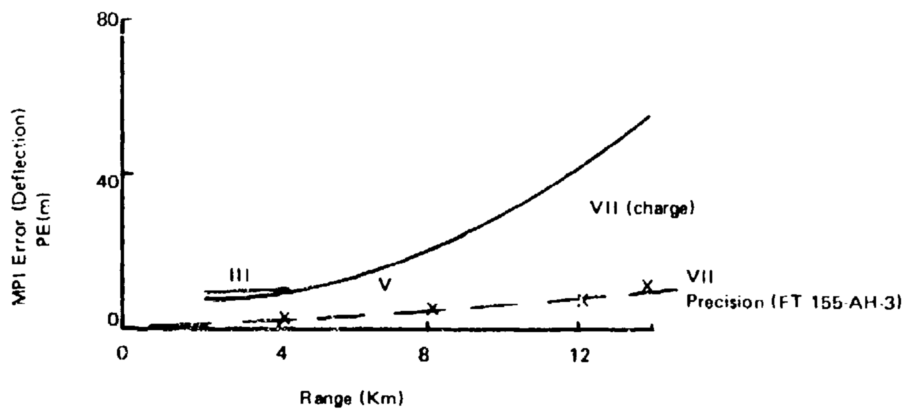


Fig 3. M109 (155mm) MPI probable error firing M107 HE projectile

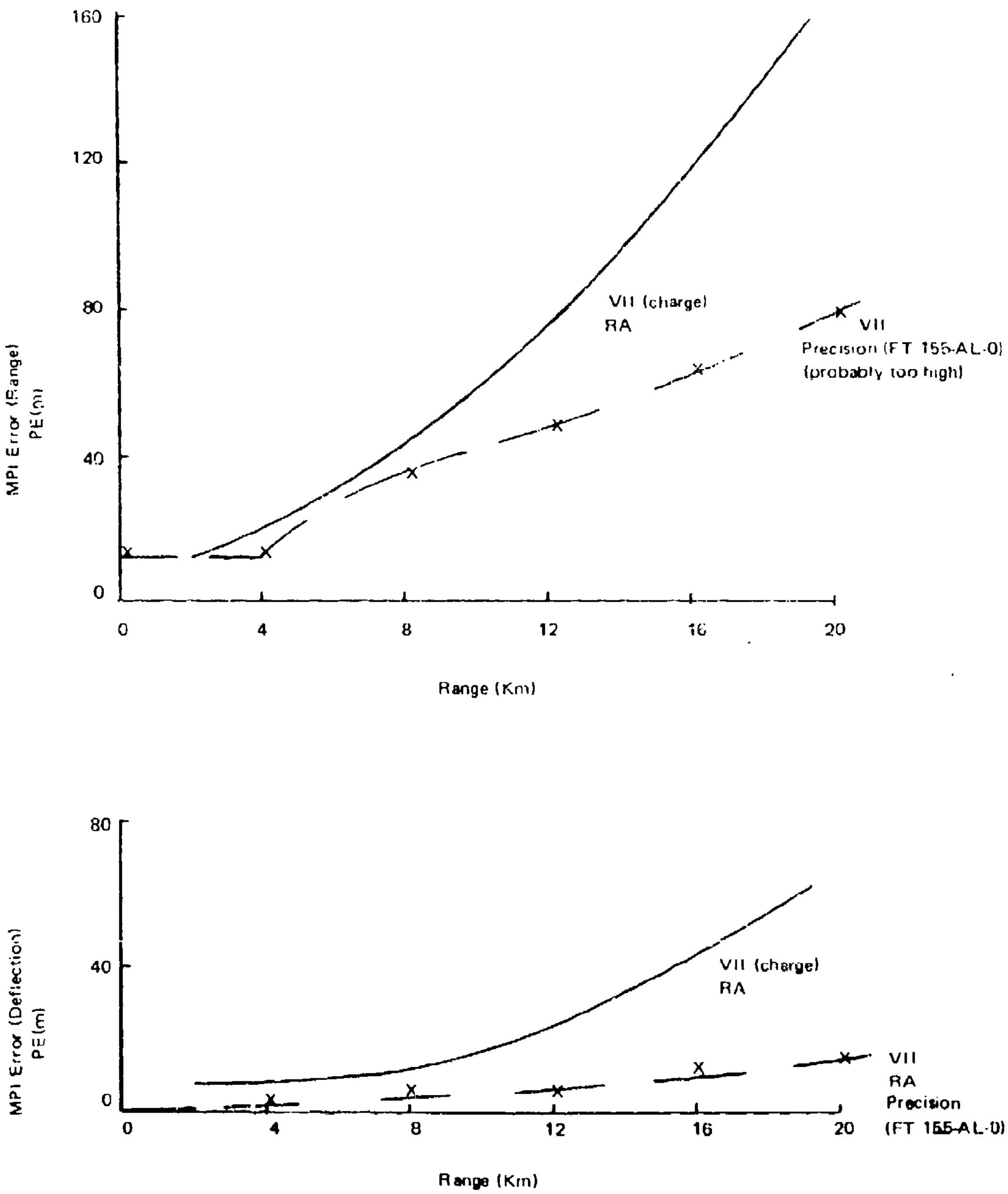
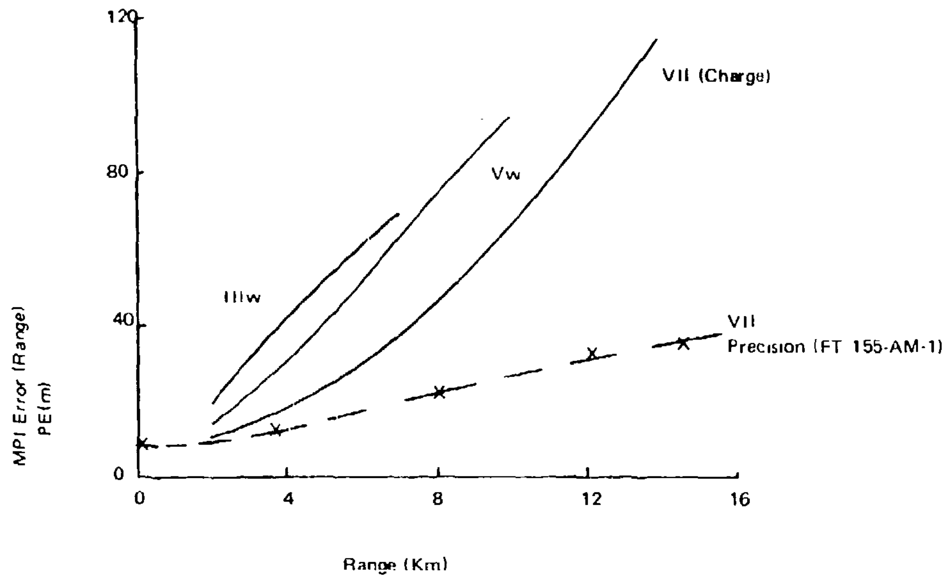


Fig 4. M109 (155mm) MPI probable error firing M549 RA projectile



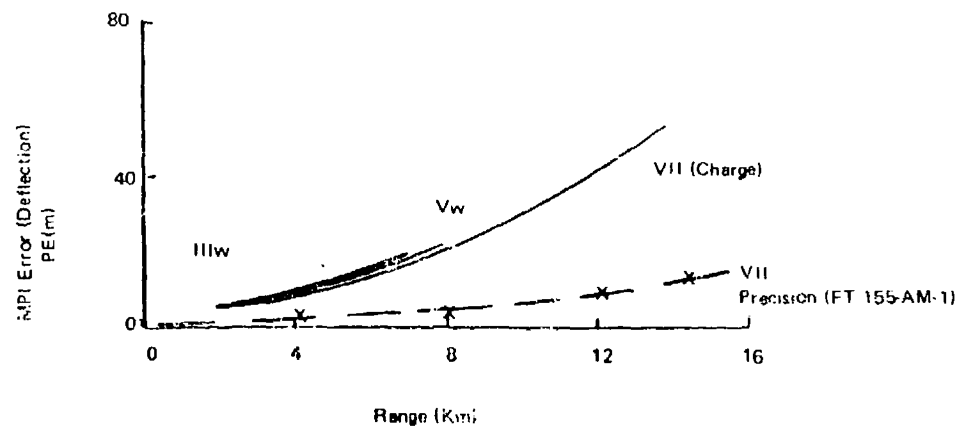
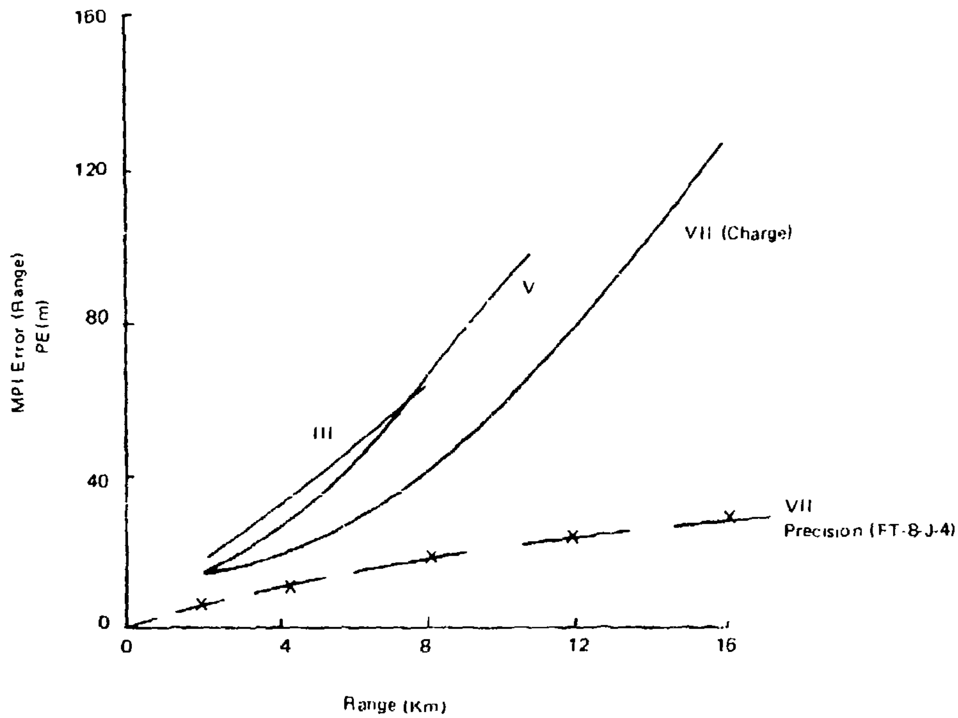


Fig 5. M109A1 (155mm) MPI probable error firing M107 HE projectile



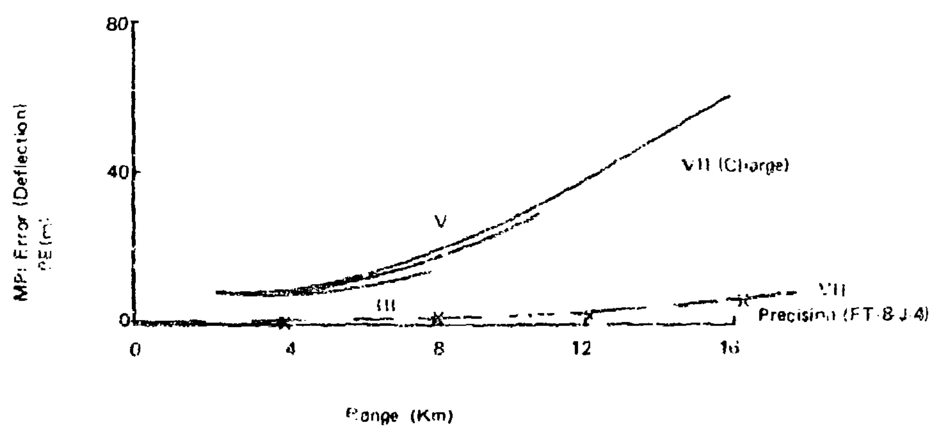


Fig 6. M110 (203mm) MPI probable error firing M106 HE projectile

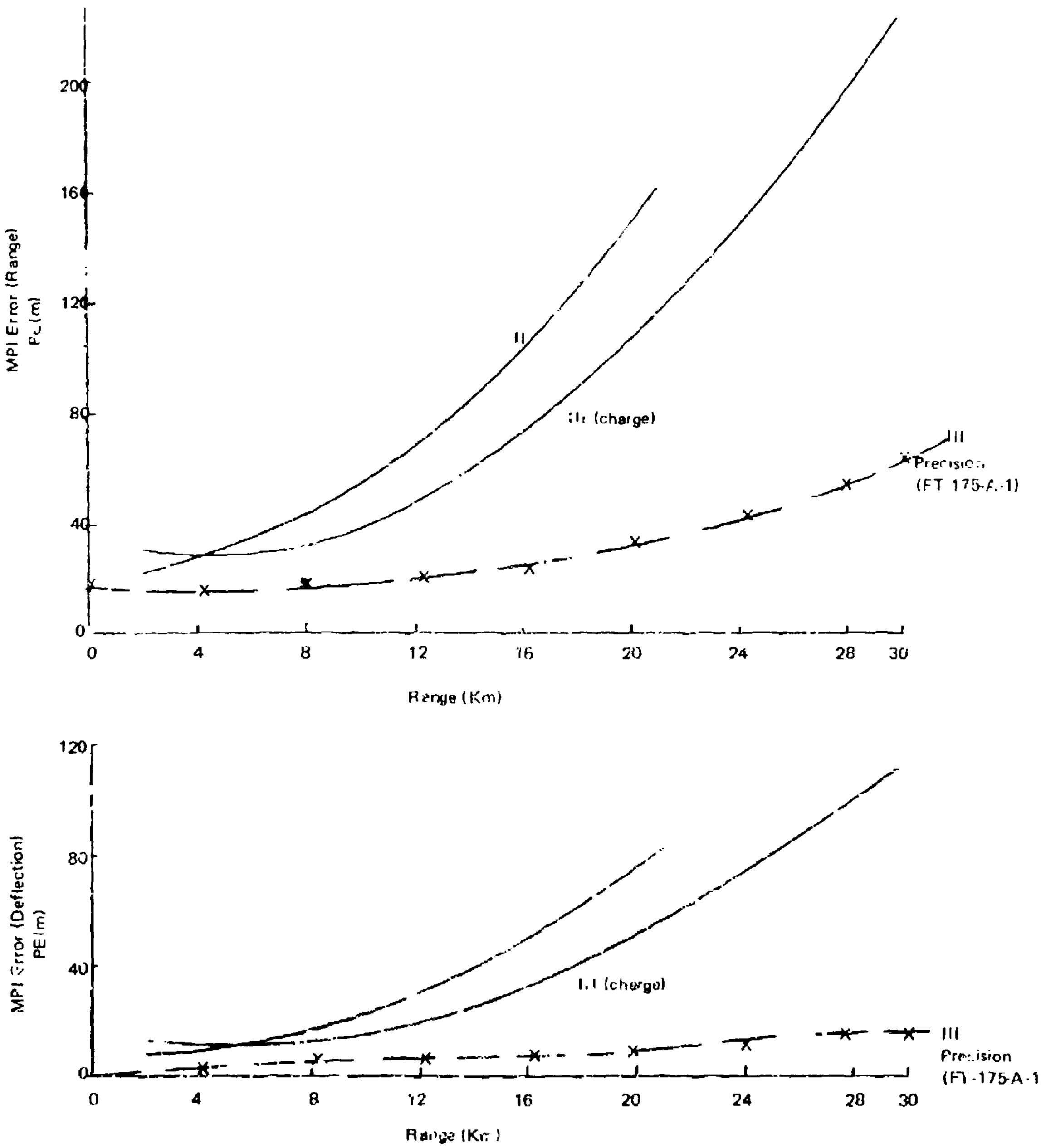


Fig 7. M107 (175mm) MPI probable error firing M437E2 HE projectile

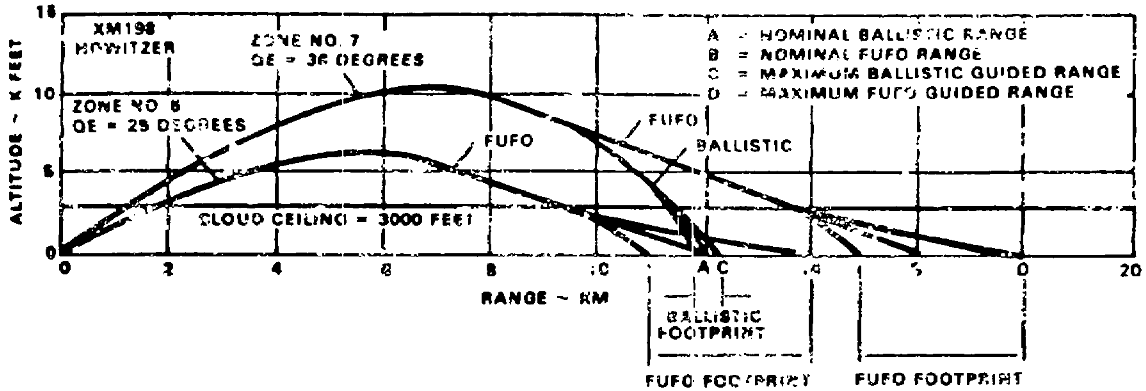


Fig 8. XM712 ballistic and FUFO trajectory option, XM198 howitzer

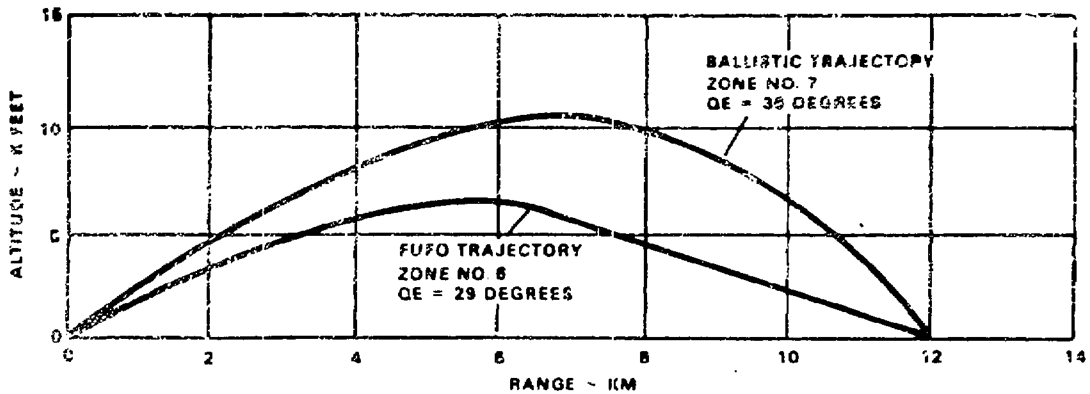


Fig 9. Shallower approach angle of FUFO compared to ballistic trajectory of same range

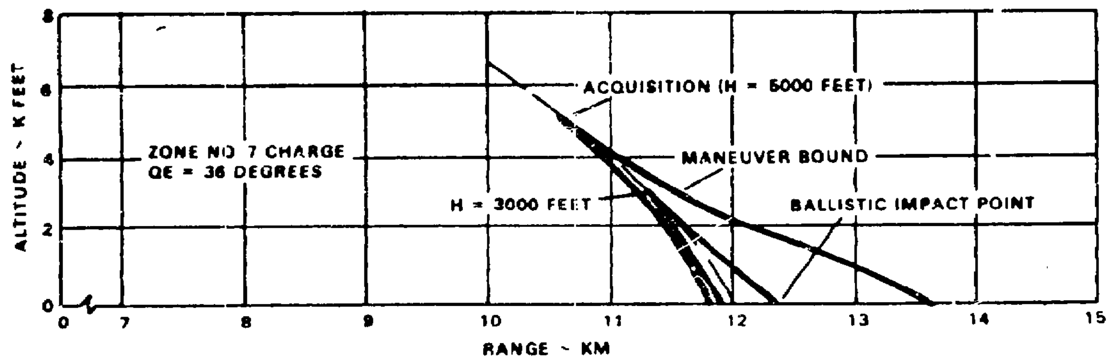


Fig 10. Ballistic trajectory maneuver bounds, 12km nominal range

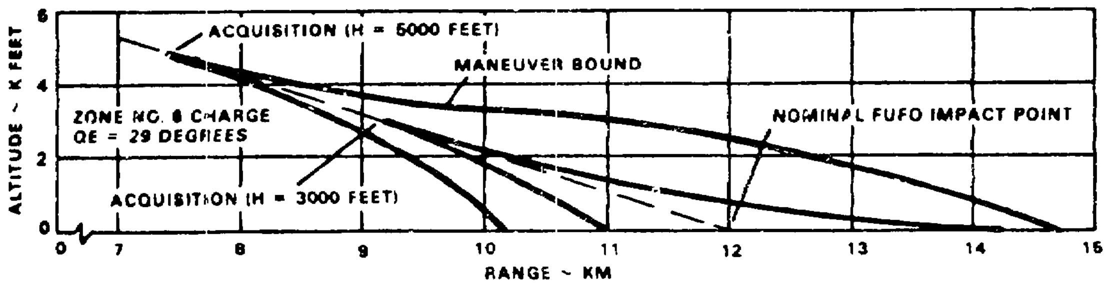
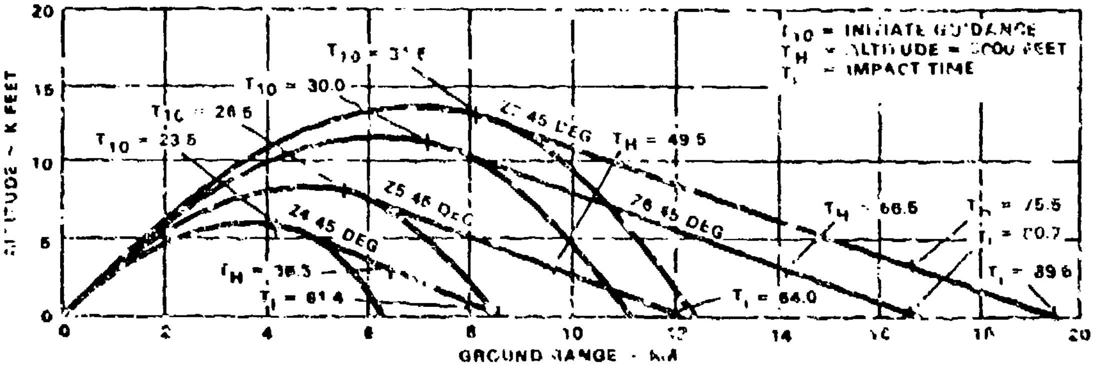


Fig 11. FUFO trajectory maneuver bounds, 12km nominal range

XM198

CHARGE	CHARGE ZONE	QE (DEG)	BALLISTIC IMPACT PT. (KM)	NOMINAL FUFO IMPACT PT. (KM)
XM201E2	Z7	45	[illegible]	[illegible]
		30	[illegible]	14.46
XM201E2	Z6	45	11.04	16.62
		30	10.11	12.63
XM164	Z5	45	8.66	12.01
		30	[illegible]	[illegible]
XM164	Z4	45	6.21	8.66



M109A1

CHARGE	CHARGE ZONE	QE (DEG)	BALLISTIC IMPACT PT. (KM)	NOMINAL FUFO IMPACT PT. (KM)
M4A2	Z7	45	10.20	15.10
		30	19.31	11.46
M4A2	Z6	45	8.69	12.38
		30	7.89	9.43
M4A2	Z5	45	7.06	9.33
M3A1	Z4	45	6.68	7.24

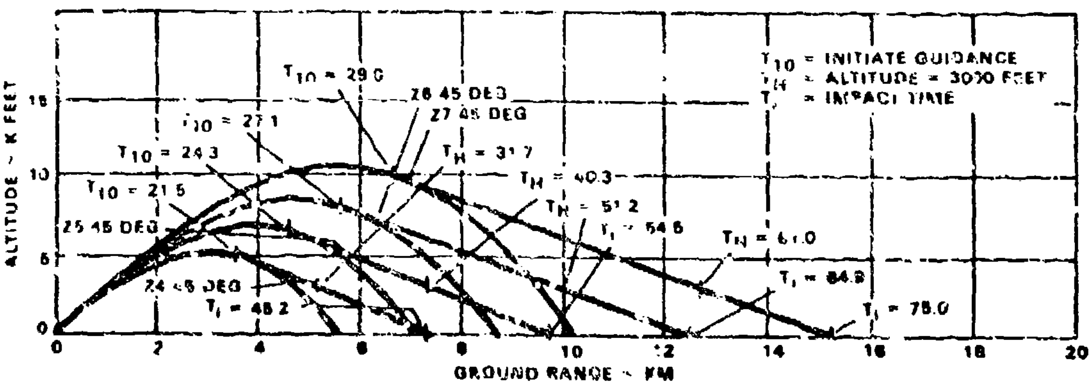


Fig 12. FUFO range extension for XM198 howitzer

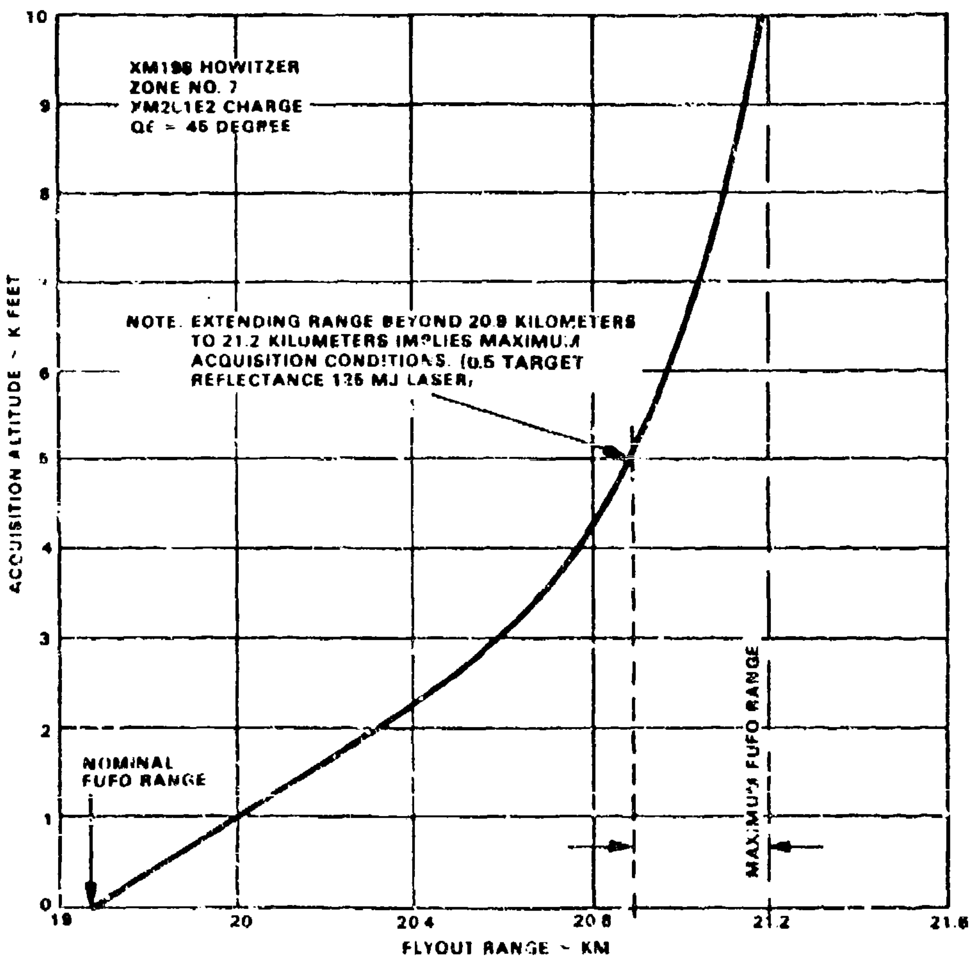


Fig 13. Maximum FUFO guided range, XM198 howitzer

M109A1

QE (DEG)	BALLISTIC IMPACT POINT (KM)	IMPACT TIME (SEC)
75	4.34	49.5
70	5.14	48.1
65	5.79	46.0
30	5.62	27.3
15	3.60	14.6
11.25	2.86	11.1

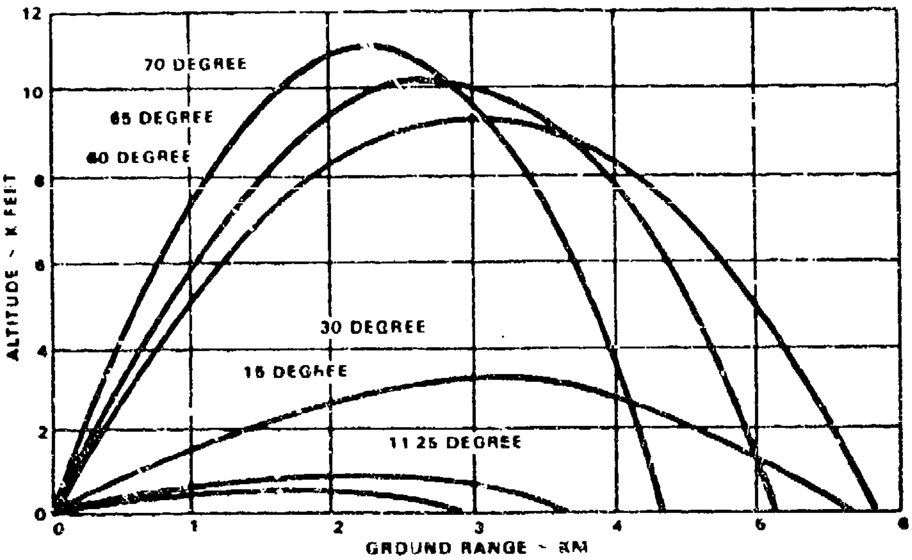


Fig 14. Minimum range trajectories with M109A1 howitzer, charge 4

XM198

QE (DEG)	BALLISTIC IMPACT POINT (KM)	IMPACT TIME (SEC)
75	2.81	48.3
70	3.68	47.0
65	4.78	46.3
30	4.80	26.2
15	3.16	13.6
11.25	2.46	10.3

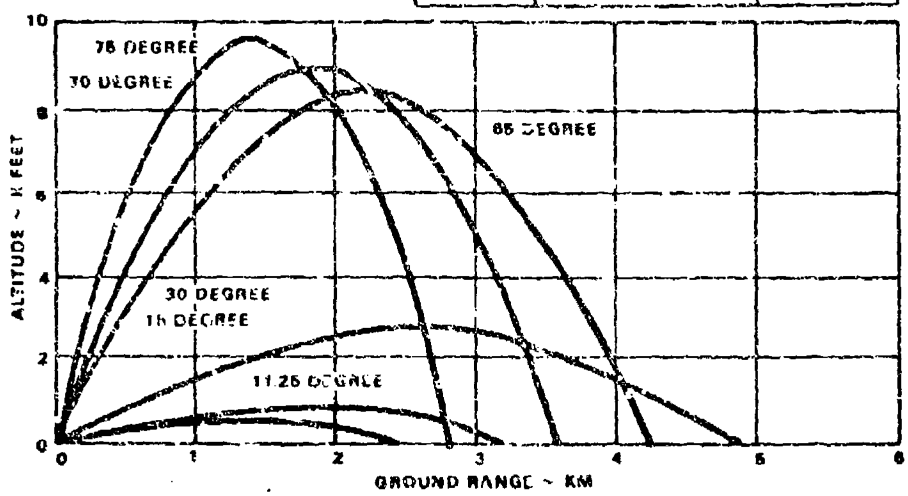


Fig 15. Minimum range trajectories with XM198 howitzer, charge 4

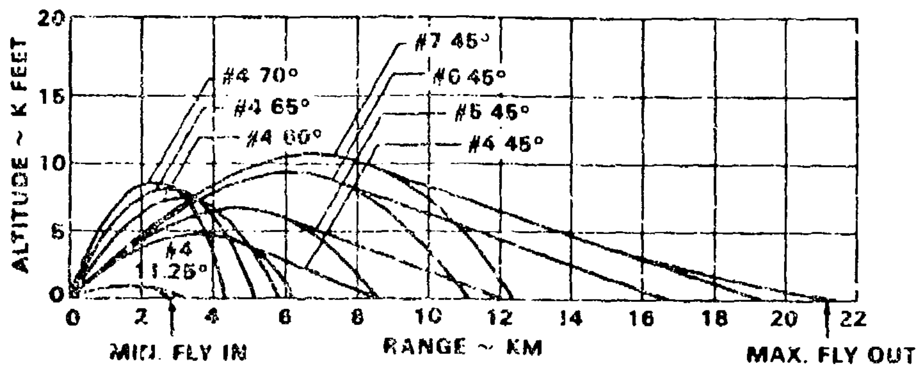


Fig 16. Trajectory flexibility due to FUFO and high/low QE options

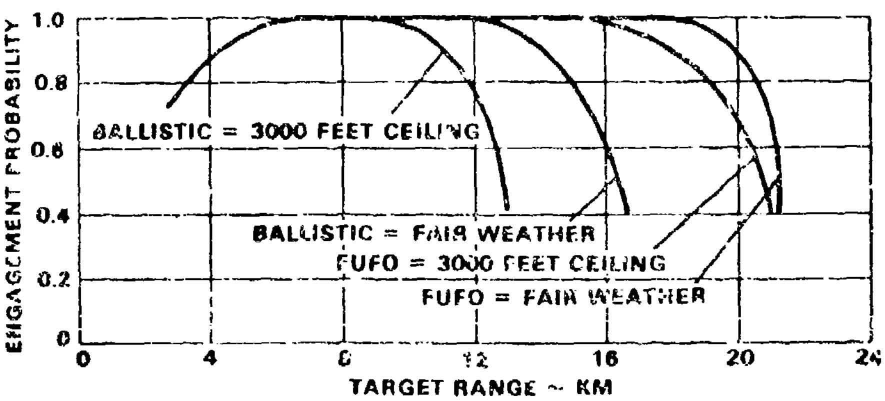


Fig 17. Engagement probability, ballistic and FUFO

APPENDIX A

COMPACTED FIRING TABLES OR SIMULATIONS

Table A-1

M30 mortar, 4.2-inch, firing M329A1

Basic Projectile: M329A1, fuze M557 — Elevation: 800 mils

Source: FT4.2-H-2 — Also Currently Used for Shell: M328A1

Basic		Charge Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Charge	Range	1/8 Inc.	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std. (2 Sq)		Range	Defl.
Inc	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
WITHOUT EXTENSION																
5	1020	15	41.1	[illegible]	18.8	-17.7	1.2	-0.8	0.0	0.0	-1.0	1.0	-7	7	9	1
7½	1430	18	36.0	0.6	20.5	-19.6	1.8	-1.2	0.0	0.0	-1.6	1.7	-8	8	12	2
10	1810	19	34.1	0.7	21.9	-21.2	2.4	-1.7	0.0	0.0	-2.6	2.6	-9	9	14	2
12½	2200	20	33.8	0.7	22.9	-22.4	3.2	-2.3	0.0	0.0	-3.7	3.8	-9	9	17	3
15	2620	21	34.4	0.8	23.7	-23.3	4.0	-3.0	0.0	0.0	-5.2	5.3	-10	10	20	4
17½	3050	22	35.4	0.8	24.2	-23.9	4.8	-3.7	0.0	0.0	-6.8	[illegible]	-11	11	23	5
20	3490	22	36.7	0.9	24.5	-24.4	5.8	-4.4	0.0	0.0	-8.5	9.1	-11	12	26	6
23	4020	22	38.3	0.9	24.7	-24.7	6.9	-5.3	0.0	0.0	-11.3	11.8	-13	14	30	7
25½	4380	22	39.5	1.0	24.8	-24.8	7.8	-6.0	0.0	0.0	-13.2	13.7	-15	15	32	8
WITH EXTENSION																
25½	3830	15	27.6	0.8	25.5	-25.4	6.1	-4.7	0.0	0.0	-9.8	10.1	-14	15	23	5
28	4120	15	28.4	0.9	25.6	-25.5	6.7	[illegible]	0.0	0.0	[illegible]	11.6	-14	15	25	5
30	4360	15	28.9	0.9	25.7	-25.6	7.2	-5.6	0.0	0.0	-12.4	12.9	-14	15	27	5
32½	4660	15	29.6	0.9	25.7	-25.7	8.1	-6.1	0.0	0.0	-13.9	14.5	-14	14	28	6
35	4960	15	30.3	0.9	25.5	-25.7	9.1	-6.6	0.4	0.0	-15.6	16.2	-13	14	30	6
38	5310	15	31.0	1.0	24.8	-25.4	10.6	-7.3	1.6	-0.4	-17.6	18.4	-12	13	32	7
41	5650	14	31.7	1.0	23.5	-24.5	12.3	-7.9	3.7	[illegible]	-19.7	20.7	-10	[illegible]	34	7

SARPA-FR (OT) 2768 Dec 75

Table A-1 (continued)

Basic Projectile: M329A1, fuze M557   Elevation: 900 mils

Source: FT4.2-H-2   Also Currently Used for Shell: M328A1

Basic		Charge Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Charge	Range	1/8 Inc.	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std. 2 Sq		Range	Defl.
Inc	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
WITHOUT EXTENSION																
5	1060	16	35.4	0.6	18.5	-17.4	1.3	-0.3	0.0	0.0	-0.9	1.0	-7	7	9	1
7½	1400	18	33.0	0.7	20.2	-19.3	1.8	-1.1	0.0	0.0	-1.6	1.6	-8	8	11	2
10	1770	19	33.4	0.7	21.5	-20.8	2.5	-1.3	0.0	0.0	-2.5	2.6	-8	9	14	3
12½	2160	20	35.2	0.8	22.6	-22.0	3.3	-2.4	0.0	0.0	-3.7	3.8	-9	9	16	3
15	2570	21	37.5	0.9	23.3	-22.9	4.2	-3.0	0.0	0.0	-5.1	5.2	-10	10	20	4
17½	3000	21	40.1	0.9	23.9	-23.6	5.[illegible]	-3.7	0.0	0.0	-6.7	6.9	-10	11	23	5
20	3430	20	42.7	1.0	24.2	-24.0	6.0	-4.5	0.0	0.0	-8.6	8.9	-11	12	26	6
23	3950	23	45.9	1.0	24.5	-24.4	7.2	-5.[illegible]	0.0	0.0	-11.1	11.6	-13	14	29	7
25½	4390	22	48.4	1.1	24.5	-24.5	6.4	-6.3	0.0	0.0	-13.4	14.0	-15	16	32	8
WITH EXTENSION																
25½	3720	14	29.6	1.0	24.6	-24.5	6.6	-4.9	0.0	0.0	-9.8	10.1	-13	14	23	5
28	4000	14	30.4	1.0	24.7	-24.6	7.2	-5.4	0.0	0.0	-11.2	11.6	-13	14	24	5
30	4230	14	30.9	1.0	24.8	-24.7	7.7	-5.9	0.0	0.0	-12.3	12.8	-13	14	26	5
32½	4520	14	31.7	1.1	24.8	-24.8	8.6	-6.4	0.0	0.0	-13.9	14.5	-13	13	27	6
35	4800	14	32.3	1.1	24.6	-24.8	9.6	-6.9	0.4	0.0	-15.5	16.2	-12	13	29	6
38	5150	38	33.1	1.1	23.9	-24.5	11.0	-7.6	1.5	-0.4	-17.5	18.3	-11	12	31	6
41	5480	41	33.8	1.1	22.7	-23.6	12.7	-8.[illegible]	3.5	-1.3	-19.5	20.6	-9	10	33	7

SARPA-FR (OT) 2768 Dec 75

Table A-1 (continued)

Basic Projectile: M329A1, fuze M557 Elevation: 1065 mils

Source: FT4.2-H-2 Also Currently Used for Shell: M328A1

Basic		Charge Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Charge	Range	1/8 Inc.	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std. 2 Sq		Range	Defl.
Inc	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
WITHOUT EXTENSION																
5	920	14	79.7	0.9	15.0	-15.0	1.5	-0.9	0.0	0.0	-1.0	1.0	-6	5	8	1
7½	1220	15	60.9	0.9	17.5	-16.7	2.1	-1.4	0.0	0.0	-1.6	1.6	-6	7	10	2
10	1540	17	52.7	1.0	18.8	-18.1	2.8	-1.9	0.0	0.0	-2.4	2.5	-7	7	12	2
12½	1890	18	50.0	1.1	19.9	-19.3	3.6	-2.5	0.0	0.0	-3.4	3.5	-8	8	15	3
15	2240	19	50.2	1.1	20.9	-20.4	4.4	-3.1	0.0	0.0	-4.7	4.8	-8	9	17	3
17½	2620	19	51.9	1.2	21.7	-21.3	5.3	-3.8	0.0	0.0	-6.1	6.3	-9	10	20	4
20	3020	20	54.6	1.2	22.5	-22.1	6.2	-4.5	0.0	0.0	-7.7	8.0	-11	11	23	5
23	3510	21	58.3	1.2	23.3	-23.0	7.2	-5.0	0.0	0.0	-9.9	10.2	-13	14	26	6
25½	3930	21	61.7	1.3	24.0	-23.6	8.2	-6.1	0.0	0.0	-11.9	12.3	-16	17	29	7
WITH EXTENSION																
25½	3260	13	39.1	1.2	22.5	-22.2	6.8	-4.9	0.0	0.0	-8.8	9.1	-12	13	20	4
28	3520	13	39.9	1.3	22.9	-22.6	7.4	-5.3	0.0	0.0	-10.1	10.4	-12	13	21	4
30	3730	13	40.6	1.3	23.2	-22.9	7.9	-5.3	0.0	0.0	-11.1	11.5	-13	13	23	5
32½	4000	14	41.3	1.3	23.5	-23.2	8.6	-6.3	0.0	0.0	-12.4	12.9	-13	13	24	5
35	4270	14	42.1	1.3	23.7	-23.6	9.4	-6.8	0.3	0.0	-13.8	14.3	-13	13	26	5
38	4600	14	42.9	1.3	23.5	-23.7	10.6	-7.4	1.3	-0.3	-15.6	16.2	-12	13	28	6
41	4930	13	43.7	1.4	22.9	-23.4	11.9	-8.1	2.0	-1.1	-17.4	18.1	-11	12	30	6

SARPA-FA (OT) 2768 Dec 75

Table A-2

M30 mortar, 4.2-inch, firing M329A2 (M329A1E1)

Basic Projectile: M329A1E1, fuze M557 Elevation: 800 mils

Source: FT4.2-K-1 Also Currently Used for Shell:

Basic		Charge Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Charge	Range	1/8 Inc.	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Inc.	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
0	910	21	17.6	.3	18.6		.6			0	-.4	.4			6	2
2½	1350	23	17.5	.4	21.6	-20.3	1.0	-.[illegible]	0	0	-1.0	1.0			9	4
5	1810	24	17.5	.4	23.9	-22.8	1.6	-1.1	0	0	-1.7	-1.7			13	5
7½	2290	24	17.4	.5	25.8	-24.9	2.2	-1.6	0	0	-2.7	2.7			16	6
10	2770	24	17.4	.5	27.2	-26.4	2.8	-2.2	0	0	-3.9	4.0			19	7
12½	3240	23	17.4	.5	28.[illegible]	-27.7	3.5	-2.7	0	0	-5.2	5.3			22	9
15	3700	23	17.4	.6	29.[illegible]	-28.6	4.2	-3.3	0	0	-6.7	6.9			26	10
17½	4140	22	17.5	.6	29.8	-29.4	4.9	-3.8	0	0	-8.2	8.5	NOT APPLICABLE	NOT APPLICABLE	29	11
20	4570	21	17.6	.6	30.3	-30.0	5.5	-4.4	0	0	-9.9	[illegible]			32	12
22½	4990	21	17.8	.[illegible]	30.7	-30.4	6.2	-5.0	0	0	-11.6	12.0			35	13
25	5400	20	17.9	.[illegible]	31.1	-30.8	6.8	-5.5	0	0	-1[illegible].4	13.9			[illegible]	14
27½	5810	20	18.0	.[illegible]	3[illegible].3	-31.[illegible]	7.9	-6.[illegible]	0	0	-15.[illegible]	15.9			40	15
30	6210	20	18.0	.[illegible]	31.3	-31.4	10.7	-6.5	1.2	0	-17.2	17.[illegible]			43	16
32	6530	20	18.1	.[illegible]	29.8	-31.3	[illegible]1.1	-7.1	[illegible].0	.2	-18.9	19.7			4[illegible]	17
34	6840	18	18.2	.[illegible]	29.8	-29.4	1[illegible].1	-7.5	[illegible].6	-2.1	-2[illegible].5	20.[illegible]			47	18

SARPA-FR (OT) 2765 Dec 75

Table A-2 (continued)

Basic Projectile: M329A1E1, fuze M55? Elevation: 900 mils

Source: FT4.2-K-1 Also Currently Used for Shell: ____

Basic		Charge Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Charge	Range	1/8 Inc.	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Inc	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
0	880	20	22.4	.4	18.1		[illegible]								6	3
2½	1310	22	22.1	.4	21.0	-19.8	1.1	-.4		0	-.9	1.0			9	4
5	1[illegible]70	23	22.0	.5	23.3	-22.3	1.7	-1.1	0	0	-1.7	1.7			12	6
7½	2240	23	22.0	.5	25.1	-24.2	2.3	-1.5	0	0	-2.7	2.8			16	7
10	2700	[illegible]3	21.9	.6	26.4	-25.7	3.0	-2.2	0	0	-3.9	4.0			19	[illegible]
12½	3160	[illegible]3	21.9	.6	27.[illegible]	-26.9	3.8	-2.8	0	0	-5.2	5.4			22	10
15	3690	22	21.[illegible]	.7	26.3	-27.8	4.5	-1.4	0	0	-6.7	6.9			25	12
17½	4030	21	22.0	.7	28.9	-28.5	5.2	-4.0	0	0	-3.2	8.5			[illegible]3	13
20	4450	21	22.1	.7	29.4	-29.1	5.[illegible]	-4.6	0	0	-9.9	10.2	NOT APPLICABLE	NOT APPLICABLE	31	15
22½	4860	20	22.3	.7	29.8	-29.5	6.6	-5.1	0	0	-11.6	12.0			34	16
25	5260	20	22.4	.8	30.1	-29.9	7.3	-5.7	0	0	-13.4	13.9			36	17
27½	5650	20	22.4	.8	30.4	-30.2	8.3	-6.3	0	0	-15.2	15.8			39	19
30	6040	20	22.4	.8	30.4	-30.4	10.8	-6.9	1.1	0	-17.2	17.8			42	20
32	63[illegible]0	19	22.5	.8	29.0	-30.4	11.0	-7.3	5.5	-.2	-18.7	19.6			44	21
3[illegible]	6650	1[illegible]	22.7	.8	29.0	-28.6	11.0	-7.8	10.4	-2.0	-20.4	20.0			46	22

SARPA-FR (OT) 2765 Dec 75

Table A-2 (continued)

Basic Projectile: M329A1E1 fuze M557 Elevation: 1065 mils

Source: FT4.2-K-1 Also Currently Used for Shell: ____

Basic		Charge Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Charge	Range	1/8 Inc.	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl
Inc	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
0	770	13	37.1	.6	16.0		.5								5	4
2½	1150	20	34.5	.6	18.5	-17.5	1.0			0	-.7	.8			8	6
5	1560	20	33.7	.7	20.6	-19.7	1.7			0	-1.5	1.5			11	9
7½	1970	21	33.4	.7	22.1	-21.3	2.3	-1.4		0	-2.4	2.4			14	11
10	2380	20	33.2	.8	23.3	-22.7	3.1	-1.7	0	0	-3.4	3.5			16	13
12½	2780	20	33.1	.8	24.2	-23.7	3.8	-2.4	0	0	-4.6	4.7			19	16
15	3170	19	33.1	.9	24.9	-24.5	4.5	-3.1	0	0	-5.9	6.1	NOT APPLICABLE	NOT APPLICABLE	22	18
17½	3550	19	33.1	.9	25.5	-25.1	5.2	-3.7	0	0	-7.3	7.5			25	20
20	3920	18	33.2	.9	25.9	-25.6	6.0	-4.3	0	0	-8.8	9.1			27	22
22½	4280	18	33.3	.9	26.3	-26.1	6.7	-4.9	0	0	-10.3	10.7			30	24
25	4630	17	33.5	1.0	26.6	-26.4	7.4	-5.5	0	0	-11.9	12.3			32	26
27½	4980	17	33.5	1.0	26.[illegible]	-26.7	8.3	-6.0	0	0	-13.6	14.1			34	28
30	5320	17	33.5	1.0	26.9	-26.9	10.3	-6.5	.9	0	-15.2	15.9			37	30
32	5600	17	33.6	1.0	25.8	-26.9	10.3	-7.1	[illegible]	-.2	-16.7	17.3			39	32
34	5850	15	33.7	1.1	25.8	-25.5	10.3	-7.5	8.8	-1.7	-18.1	17.8			41	33

SAPPA-FR (C?) 2788 Dec 75

Table A-3

M101, M101A1 howitzer, 105mm, firing M1

Basic Projectile: M1, Fuze M557 Charge: 1 (195.1 m/s)

Source: FT 105-H-7 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	136.7	7	2.1	.07	10.7	-9.2	.2	-.2	0	0	-.3	.3	-16	17	6	1
2000	295.5	6	5.0	.14	20.7	-18.0	.7	-.6	0	0	-1.2	1.3	-30	31	12	1
3000	520.7	3	9.8	.24	29.9	-26.2	1.7	-1.3	0	0	-2.8	2.9	-42	44	14	2
3400	721.3	2	15.8	.33	30.7	-29.3	2.3	-1.8	0	0	-3.7	3.5	-46	46	19	2
3000	1042.4	3	35.1	.59	29.6	-25.7	2.5	-1.2	0	0	-3.4	3.4	-39	41	19	3
2000	1252.1	7	122.8	1.39	20.7	-19.4	.3	.1	0	0	-.5	1.0	-24	26	16	3
1825	1275.0	7	152.4	1.39	20.0	-19.4	-.4	.1	0	0	-.5	.5	.22	24	16	3

SARPA-FR (OT) 2768 Dec 75

Table A-3 (continued)

Basic Projectile: M1, Fuze M557 Charge: 2 (211.8 m/s)

Source: FT 105-H-? Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Flev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	115.5	8	1.7	.06	9.8	-8.6	.1	-.1	0	0	-.3	.3	-16	17	6	1
2000	246.2	7	4.0	.13	19.0	-16.7	16	-.5	0	0	-1.2	1.2	-30	31	12	1
3000	410.9	5	7.3	.21	27.5	-24.3	1.4	-1.2	-.1	0	-2.8	2.8	-42	44	18	2
3900	688.8	2	14.7	.34	32.2	-30.7	2.7	-2.2	-.1	0	-4.8	5.0	-51	52	22	2
3000	1147.5	5	50.5	.81	26.5	-23.7	2.6	.1	0	0	-3.5	3.7	-37	39	19	4
1999	1290.0	9	205.2	1.60	19.5	-19.1	-.6	.1	0	0	-.6	0	-26	27	15	4

SARPA-FR (OT) 2768 Dec 75

Table A-3 (continued)

Basic Projectile: M1, Fuze M557 Charge: 3 (233.2 m/s)

Source: FT 105-H-7 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	95.0	10	1.4	.05	8.9	-7.9	.1	-.1	0	0	-.3	.3	-15	16	6	1
2000	200.1	9	3.2	.11	17.2	-15.3	.5	-.5	-.2	.1	-1.2	1.2	-29	30	11	1
3000	324.0	7	5.4	.18	25.0	-22.4	1.1	-1.1	-.3	.2	-2.7	2.8	-40	41	17	2
4000	490.9	5	9.0	.24	32.1	-29.0	2.2	-1.9	-.3	.2	-4.8	4.9	-49	51	23	3
4600	677.5	2	14.2	.36	34.1	-32.7	3.3	-2.7	-.3	.2	-6.5	6.8	-53	54	27	[illegible]
4500	1066.3	5	37.0	.67	31.6	-28.1	3.7	-2.3	-.2	.1	-6.0	[illegible]	-44	46	24	5
3000	1227.2	8	76.8	1.17	24.2	-21.9	2.4	.7	-.2	.1	-3.4	[illegible]	-31	33	17	5
2295	1300.0	12	105.9	1.79	20.4	-19.5	-.4	.7	-.2	.1	-1.5	[illegible]	-21	21	17	5

SARPA-FR (OT) 2768 Dec 75

Table A-3 (continued)

Basic Projectile: M1, Fuze M557 Charge: 4 (262.1 m/s)

Source: FT 105-H-? Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity/ 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	74.9	13	1.0	.05	7.9	-7.1	.1	-.1	0	0	-.3	.3	-13	13	6	1
2000	156.4	12	2.4	.09	15.3	-13.8	.4	-.4	-.2	.2	-1.2	1.2	-23	24	11	1
3000	248.1	10	4.0	.15	22.4	-20.2	.9	-.8	-.4	.4	-2.5	2.7	-33	34	16	2
4000	357.4	8	6.0	.21	29.0	-26.3	1.6	-1.5	-.8	.6	-4.6	4.7	-40	41	22	2
5000	505.4	5	9.3	.29	35.0	-32.0	2.8	-2.5	-1.0	.7	-7.2	7.4	-45	47	29	3
5700	721.4	2	15.7	.40	36.6	-35.7	4.1	-3.4	-.9	.7	-9.5	9.6	-47	49	33	4
5000	1047.1	5	34.6	.67	34.3	-30.9	4.7	-3.6	-.7	.5	-9.0	9.1	-39	41	31	6
4000	1192.5	8	58.5	98	27.8	-25.2	4.0	-.9	-.5	.4	-6.4	5.7	-30	32	24	6
3000	1290.6	13	141.4	1.94	21.8	-20.4	1.1	-.9	-.4	.3	-2.9	3.2	-17	20	20	6
2733	1310.0	14	186.1	1.94	20.8	-20.4	-.5	-.9	-.5	.3	-2.9	1.9	-13	15	20	6

SARPA-FR (CT) 2.5? Dec 75

Table A-3 (continued)

Basic Projectile: M1, Fuze M557 Charge: 5 (301.8 m/s)

Source: FT 105-H-7 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	56.4	17	.7	.04	6.7	-5.9	.5	-.1	.6	-.1	-.3	.3	-11	11	6	1
2000	117.0	16	1.6	.08	12.9	-11.2	1.3	-.4	1.7	-.2	-1.1	1.1	-20	21	10	1
3000	183.1	14	2.7	.12	18.9	-16.4	2.3	-.8	2.6	-.2	-2.5	2.5	-28	29	14	2
4000	257.2	13	4.0	.17	24.6	-21.4	3.3	-1.3	3.2	0	-4.4	4.5	-34	36	19	2
5000	343.4	11	5.6	.22	30.0	-26.2	4.3	-2.0	3.4	.3	-6.8	7.0	-40	42	26	3
6000	451.7	8	7.9	.28	35.2	-31.0	5.4	-2.9	3.2	.7	-9.8	10.1	-43	46	33	4
7000	625.0	4	12.4	.38	39.0	-35.6	6.8	-4.1	2.8	.9	-13.5	14.1	-45	48	42	5
7200	697.4	3	14.7	.42	39.0	-36.5	6.8	-4.5	2.7	.8	-14.4	14.7	-45	48	42	5
7000	921.7	4	24.8	.58	39.0	-35.3	6.8	-5.8	2.4	.7	-15.3	15.2	-41	45	45	7
6000	1094.3	8	39.4	.76	34.3	-30.5	6.7	-4.7	2.0	.5	-12.8	13.0	-34	38	38	7
5000	120.15	11	59.0	1.02	28.9	-25.8	5.7	-1.8	1.7	.4	-9.9	10.2	-27	30	31	8
4000	1282.0	15	108.0	1.64	23.7	-21.3	3.6	-1.3	1.5	.4	-5.9	6.8	-17	20	27	8
3355	1320.0	19	197.3	2.13	21.0	-19.9	-.1	-1.3	1.4	.3	-4.8	3.3	-5	9	22	7

SARPA-FR (OT) 2768 Dec 75

Table A-3 (continued)

Basic Projectile: M1, Fuze M557 Charge: 6 (365.8 m/s)

Source: FT 105-H-7 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	40.8	23	.5	.10	4.5	-4.5	.4	-.6	.5	-1.4	-.8	.7	-8	8	6	1
2000	87.7	20	1.2	.16	7.0	-7.1	1.9	-2.2	4.3	-5.6	-2.1	2.0	-11	11	7	1
3000	139.0	19	2.0	.21	8.7	-8.8	4.1	-4.1	9.9	-10.6	-3.7	3.6	-11	12	9	2
4000	195.0	17	3.0	.25	10.2	-10.3	6.5	-6.0	15.6	-15.5	-5.7	5.6	-11	12	11	2
5000	256.6	15	4.1	.30	11.8	-11.7	8.9	-7.9	21.0	-20.0	-8.1	8.3	-9	10	14	3
6000	326.0	13	5.4	.34	13.5	-13.1	11.2	-9.8	25.5	-24.0	-11.1	11.2	-7	9	17	4
7000	407.4	11	7.2	.39	15.3	-14.7	13.4	-11.6	29.2	-27.3	-14.6	14.9	-4	6	22	4
8000	511.8	8	9.7	.45	17.5	-16.5	15.5	-13.3	31.8	-29.2	-18.8	19.4	0	2	27	5
9000	708.2	3	15.7	.57	19.6	-18.7	15.9	-14.8	32.6	-31.6	-23.9	24.0	6	-2	23	7
8000	1044.1	8	35.6	.89	18.9	-17.6	15.5	-11.6	28.6	-25.8	-23.2	23.0	7	-3	22	9
7000	1146.1	11	48.9	1.07	16.7	-15.6	13.5	-9.1	25.0	-22.7	-19.8	19.9	7	-4	28	9
6000	1223.6	14	68.8	1.36	14.3	-13.2	11.5	-6.8	21.9	-20.1	-16.0	16.4	9	-6	23	10
5000	1285.1	19	114.0	1.96	11.6	-10.5	8.8	-4.2	19.6	-18.3	-11.2	12.2	17	-13	17	10
4111	1325.0	25	215.8	2.55	8.6	-7.6	4.3	-4.2	19.2	-18.7	-9.3	7.1	32	-30	17	9

SARPA-FR (OT) 2768 Dec 75

Table A-3 (continued)

Basic Projectile: M1, Fuze M557   Charge: 7 (464.8 m/s)

Source: FT 105-H-7   Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	25.2	36	.4	.08	4.2	-3.9	.1	-.1	-.2	.2	-.8	.9	-9	9	8	1
2000	55.7	30	1.0	.17	7.7	-7.3	.6	-.5	-.9	.8	-3.4	3.5	-13	13	8	1
3000	93.0	25	1.7	.27	10.3	-10.1	1.5	-1.4	-1.1	-.1	-6.9	6.8	-13	14	10	2
4000	136.4	22	[illegible]	[illegible]	12.0	-11.9	3.1	-2.9	1.4	-3.4	-10.2	9.6	-12	13	11	2
5000	185.0	20	3.4	.40	13.3	-13.1	5.3	-4.7	5.8	-7.6	-13.1	12.3	-10	12	12	3
6000	238.6	18	[illegible]	.45	14.2	-14.2	7.6	-6.7	10.9	-12.2	-16.0	15.3	-88	9	14	4
7000	298.0	16	5.7	.50	15.2	-15.1	10.1	-8.7	16.0	-14.6	-19.3	16.7	-4	66	15	4
8000	365.0	14	7.3	.54	16.1	-15.9	12.7	-10.8	20.6	-20.7	-23.0	22.7	1	1	16	5
9000	443.6	12	9.2	.60	17.1	-16.9	15.3	-12.8	24.5	-24.3	-27.4	27.5	7	-4	18	6
10000	544.5	8	12.1	.66	18.3	-17.9	18.3	-14.9	27.4	-27.2	-32.6	33.4	14	-11	20	7
11000	764.2	2	20.3	.77	19.5	-19.2	18.3	-16.9	28.5	-29.3	-38.9	38.3	24	-20	22	9
10000	1018.2	9	37.6	1.12	18.3	-17.9	19.0	-16.4	26.2	-25.9	-39.1	38.0	27	-23	22	11
9000	1112.3	13	49.6	1.32	16.6	-16.0	18.2	-14.5	27.6	-23.5	-34.9	34.3	26	-22	20	11
8000	1183.1	16	64.9	1.57	14.7	-14.1	16.9	-11.6	21.4	-21.4	-30.3	30.1	27	-23	17	12
7000	1240.4	19	90.1	1.94	12.6	-12.0	15.1	-6.9	19.6	-19.8	-25.1	25.5	31	-27	15	12
6000	1285.9	25	146.2	2.76	10.0	-9.2	12.5	-6.9	18.9	-19.4	-18.5	20.1	43	-39	12	11
5121	1315.0	34	248.4	3.28	6.8	-8.9	8.0	-6.9	19.3	-20.7	-18.5	12.8	47	-60	12	11

SARPA-FR (OT) 2768 Dec 75

Table A-4

M102 howitzer, 105mm, firing M1

Basic Projectile: M1, Fuze, M557 — Charge: 1 (205 m/s)

Source: FT 105-AS-2 — Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq (2 Sq Std.)		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	123.6	8	1.9	0.06	10.2	[illegible]	0.1	-0.1	-0.1	0.0	-0.3	0.3	-16	17	7	0
2000	263.9	6	4.5	0.12	19.9	-17.4	0.5	-0.4	-0.2	0.2	-1.1	1.2	-31	32	14	1
3000	445.7	4	8.9	0.20	29.0	-25.5	1.1	-1.0	-0.4	0.4	-2.6	2.6	-43	45	21	1
3700	669.6	2	17.5	0.31	32.4	-30.9	1.9	-1.7	-0.7	0.6	-4.1	4.4	-50	51	24	2
3000	1111.8	4	53.8	0.50	28.0	-24.1	2.9	-2.6	-0.5	0.4	-4.3	4.2	-38	40	20	3
2000	1296.6	6	104.0	1.54	18.3	-15.7	3.1	-2.7	-0.4	0.3	-3.3	3.3	-24	25	14	3
1700	1343.5	7	129.3	1.92	15.4	-13.2	3.2	-2.7	-0.3	0.3	-3.0	3.0	-20	21	11	3

ARPA-FR (OT) 2763 Dec 75

Table A-4 (continued)

Basic Projectile: M1, Fuze, M[illegible]   Charge: _ (223 m/s)

Source: FT 105-AS-2   Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	104.2	9	1.6	0.05	9.4	-8.2	0.1	-0.1	0.0	0.0	-0.3	0.3	-15	15	7	0
2000	219.8	8	3.6	0.11	18.2	-15.1	0.4	-0.4	-0.2	0.2	-1.1	1.1	-28	29	13	1
3000	358.7	6	6.6	0.17	26.6	-23.6	1.0	-0.5	-0.4	0.4	-2.5	2.6	-39	41	19	1
4000	505.1	3	12.5	0.2[illegible]	34.3	-30.7	2.0	-1.7	-0.8	0.7	-4.6	4.8	-49	51	25	2
4300	694.1	2	17.6	0.33	34.[illegible]	-32.8	2.5	-2.0	-0.9	0.8	-5.5	5.4	-51	52	25	2
4000	989.6	3	37.5	0.59	34.[illegible]	-29.6	3.2	-3.0	-0.8	0.7	-6.1	6.0	-45	47	25	5
3000	1196.7	6	69.1	1.03	25.1	-21.9	3.5	-3.1	-0.6	0.5	[illegible]	[illegible]	-32	34	19	6
2000	1242.1	7	122.8	1.81	16.4	-14.4	3.6	-3.1	-0.4	0.4	-3.7	3.7	-20	22	13	7

SARPA-FR (OT) 2768 Dec 75

Table A-4 (continued)

Basic Projectile: M1, Fuze, M557 Charge: 3 (247 m/s)

Source: FT 105-AS-2 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std. 2 Sq		Range	Defl.
Meters	Mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	84.7	11	1.3	0.05	8.4	-7.4	0.1	-0.1	0.0	0.0	-0.3	0.3	-14	14	6	0
2000	177.1	10	2.3	0.09	16.3	-14.5	0.4	-0.3	0.0	0.1	-1.1	1.1	-26	27	11	1
3000	282.4	9	4.9	0.15	23.8	-21.3	1.0	-0.8	-0.2	0.3	-2.5	2.5	-36	39	16	1
4000	412.8	7	7.9	0.2	31.0	27.8	1.8	-1.4	-0.4	0.6	-4.4	4.5	-45	47	22	2
5000	525.3	3	14.6	0.32	36.3	-34.0	3.2	-2.4	-0.9	1.0	-7.1	7.4	-52	54	28	3
5200	742.8	2	19.8	0.39	36.3	-35.2	3.2	-2.7	-1.1	1.1	-7.8	7.9	-53	54	28	3
5000	924.9	3	31.2	0.54	35.3	-33.1	3.7	-3.7	-1.1	1.1	-8.6	8.4	-48	52	29	5
4000	1136.5	6	55.8	0.90	29.7	-26.2	4.3	-3.9	-0.8	0.9	-7.4	7.3	-37	39	24	8
3000	1271.5	8	87.9	1.38	22.0	-19.6	4.4	-3.8	-0.6	0.6	-5.9	5.9	-27	29	18	9
2300	1341.3	9	117.6	1.83	17.4	-15.4	4.3	-3.8	-0.5	0.5	-4.0	4.9	-21	22	16	10

SARPA-FR (OT) 2768 Dec 75

Table A-4 (continued)

Basic Projectile: M1, Fuze, M557 Charge: 4 (278 m/s)

Source: FT 105-AS-2 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	66.7	14	1.0	0.04	7.3	-6.6	0.2	-0.1	0.1	0.0	-0.3	0.3	-12	12	5	0
2000	139.7	13	2.2	0.08	14.2	-12.7	0.6	-0.4	0.4	-0.1	-1.1	1.1	-22	23	9	0
3000	218.3	12	3.6	0.13	20.6	-18.5	1.3	-0.8	0.7	-0.3	-2.4	2.5	-31	32	13	1
4000	309.4	10	5.5	0.18	26.8	-24.0	2.1	-1.4	1.0	-0.3	-4.3	4.4	-38	39	18	1
5000	421.3	8	8.1	0.24	32.7	-29.4	3.1	-2.2	1.0	-0.1	-6.6	6.8	-44	45	23	2
6000	588.6	4	13.2	0.32	38.4	-34.7	4.5	-3.1	0.5	0.4	-9.7	10.1	-48	50	29	4
6300	637.2	3	17.2	0.38	38.4	-35.2	4.7	-3.6	0.2	0.7	-10.9	11.0	-48	50	29	4
6000	955.8	4	33.3	0.60	38.4	-34.0	5.2	-4.9	-0.2	0.8	-12.1	11.8	-43	46	32	8
5000	1121.8	8	52.0	0.98	31.6	-28.1	5.6	-5.0	-0.2	0.7	-10.7	10.5	-34	37	28	10
4000	1236.6	10	74.3	1.24	25.1	-22.3	5.6	-5.0	-0.1	0.5	-9.0	8.9	-26	28	23	12
3000	1333.9	11	107.2	1.79	18.6	-16.5	5.5	-4.9	-0.1	0.4	-7.1	7.0	-18	20	18	14

SARPA-FR (OT) 2768 Dec 75

Table A-4 (continued)

Basic Projectile: M1, Fuze, M557 Charge: 5 (325 m/s)

Source: FT 105-AS-2 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	49.5	19	0.7	0.05	5.3	-4.4	0.9	-0.3	2.4	-1.0	-0.4	0.4	-9	10	5	1
2000	103.2	18	1.6	0.09	9.7	-7.5	2.6	-1.0	6.8	-2.8	-1.3	1.3	-14	16	6	1
3000	161.5	16	2.5	0.14	13.7	-10.3	4.6	-1.9	11.4	-4.8	-2.7	2.7	-18	21	8	2
4000	225.7	15	3.7	0.18	17.5	-13.0	6.6	-2.9	15.5	-6.6	-4.6	4.6	-21	25	9	2
5000	297.7	13	5.1	0.22	21.3	-15.7	8.6	-4.0	19.1	-8.2	6.9	7.0	-24	28	12	3
6000	381.6	11	7.0	0.26	25.1	-18.5	10.5	-5.1	22.0	-9.4	-9.6	9.8	-25	31	14	4
7000	487.2	8	9.7	0.31	29.2	-21.5	12.0	-6.2	24.0	-10.1	-12.9	13.2	-26	33	18	4
8000	664.3	3	15.5	0.41	33.0	-25.0	12.5	-7.4	23.9	-9.9	-16.8	17.2	-27	34	22	6
8100	702.0	3	17.0	0.43	33.0	-25.4	12.5	-7.5	23.9	-9.8	-17.3	17.2	-26	34	22	6
8000	885.0	3	26.3	0.56	33.0	-26.3	12.5	-8.4	23.9	-8.1	-19.4	17.2	-25	33	24	8
7000	1052.0	C	39.3	0.78	30.1	-22.9	11.3	-8.2	19.1	-6.8	-18.0	17.6	-20	27	22	9
6000	1153.8	11	51.2	1.01	25.5	-19.3	10.3	-8.0	16.3	-5.9	-16.2	15.9	-15	21	19	10
5000	1237.0	13	64.7	1.32	20.8	-15.7	9.6	-7.8	13.7	-5.0	-14.3	14.0	-10	15	17	11
4000	1131.1	14	81.7	1.78	16.2	-12.1	911	-7.6	11.2	-4.1	-12.2	12.0	-6	10	14	11
3600	1339.2	14	90.0	2.04	14.4	-10.7	8.9	-7.6	10.1	-3.7	11.3	11.1	-4	8	13	12

SARPA-FR (OT) 2768 Dec 75

Table A-4 (continued)

Basic Projectile: M1, Fuze, M557 Charge: 6 (393 m/s)

Source: FT 105-AS-2 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	35.5	26	0.6	0.09	4.7	-4.5	0.2	0.3	0.1	-0.2	-0.9	0.9	-6	6	6	0
2000	77.9	22	1.2	0.13	7.9	-7.8	1.1	-1.3	1.2	-2.3	-2.8	2.7	-8	8	6	0
3000	126.0	20	2.1	0.24	9.9	-9.9	2.9	-2.9	5.1	-6.4	-4.9	4.6	-7	8	7	0
4000	179.0	18	3.0	0.29	11.4	-11.4	5.1	-4.8	10.2	-11.1	-7.0	6.8	-6	8	8	0
5000	237.3	16	4.2	0.34	12.7	-12.7	7.5	-6.8	15.6	-15.7	-9.5	9.3	-3	4	9	0
6000	302.2	15	5.6	0.38	14.0	-13.8	9.9	-8.6	20.6	-20.1	-12.5	12.3	0	1	10	0
7000	376.3	12	7.3	0.41	15.4	-15.1	12.4	-10.7	25.2	-24.1	-15.8	15.7	4	-2	11	1
8000	465.1	10	9.7	0.44	16.9	-16.4	14.8	-12.7	29.0	-27.6	-19.7	19.9	9	-7	13	1
9000	586.8	6	13.5	0.55	18.8	-18.0	16.6	-14.5	31.5	-30.3	-24.2	25.0	16	-13	15	1
9600	734.2	3	19.5	0.64	19.8	-19.1	16.6	-15.5	31.5	-31.4	27.5	27.1	21	-17	16	2
9000	971.7	7	34.0	0.87	19.5	-18.5	16.6	14.4	29.1	-27.0	-29.5	28.4	23	-20	17	3
8000	1083.4	11	44.5	1.07	17.3	-16.3	15.7	-13.4	25.5	-23.9	-27.1	26.3	22	-19	16	4
7000	1166.0	13	55.1	1.29	15.0	-14.1	14.6	-12.6	22.5	-21.1	-24.3	23.6	21	-18	14	5
6000	1236.3	15	67.0	1.58	12.6	-11.8	13.7	-11.9	19.5	-18.2	-21.4	20.8	19	-17	12	5
5000	1300.0	16	81.2	1.97	10.2	-9.6	13.0	-11.3	16.4	-15.3	-18.3	17.8	17	-15	11	6
4400	1336.2	17	91.4	2.29	8.8	-8.3	12.6	-11.1	14.6	-13.5	-16.4	16.0	16	-14	10	7

SARPA-FR (UT) 2768 Dec 75

Table A-4 (continued)

Bu?l? Projectile: M1, Fuze, M557 Charge: 7 (494 m/s)

Source: FT 105-AS-2 Also Currently Used for Shell: M60, M360, M84

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	49.3	34	0.9	0.15	7.3	-6.9	0.5	-0.5	-0.9	0.7	-3.3	3.3	-12	12	8	0
4000	121.3	24	2.2	0.33	11.9	-11.7	2.5	-2.4	-0.9	-0.9	-11.2	10.8	-9	10	9	0
6000	217.2	19	4.3	0.46	14.3	-14.2	6.6	-5.8	6.4	-8.3	-18.1	17.2	-3	5	11	1
7000	273.4	17	5.6	0.51	15.2	-15.1	9.0	-7.7	11.3	-12.6	-21.5	20.6	1	1	13	1
8000	336.3	15	7.2	0.56	16.0	-15.9	11.6	-9.8	16.1	-16.9	-25.2	24.5	6	-3	17	2
9000	408.	13	9.2	0.61	16.8	-16.6	14.4	-12.9	20.6	-20.9	-29.3	28.8	12	-9	15	2
10000	495.	10	12.1	0.67	17.7	-17.5	17.3	-14.0	24.6	-24.6	-34.0	33.9	17	-15	16	2
11000	615.0	6	16.8	0.74	18.8	-18.4	18.9	16.2	27.5	-27.5	-39/3	40.9	27	-23	18	3
11500	728.4	3	22.4	0.82	19.3	-19.0	18.9	-17.3	27.5	-28.6	-42.5	42.0	33	-28	50	4
11000	952.3	7	38.9	1.08	19.0	-18.4	19.9	-18.5	26.0	-25.9	-44.8	43.8	37	-33	20	5
10000	1057.0	12	51.1	1.29	17.3	16.8	19.6	-17.9	23.6	-23.6	-43.4	41.5	36	-32	19	5
9000	1132.2	15	63.0	1.52	15.5	-15.0	19.0	-17.2	21.2	-21.4	-39.6	38.1	34	-30	17	6
8000	1195.4	17	76.2	1.78	13.6	-13.2	18.3	-16.5	19.1	-19.2	-35.6	34.4	31	-28	16	6
7000	1251.9	18	91.8	2.09	11.8	-11.3	17.7	-16.1	17.0	-17.0	-31.5	30.5	28	-25	14	7
6000	1304.2	20	111.1	2.50	9.9	-9.6	17.1	-15.5	14.8	-14.8	-27.3	26.5	25	-23	12	7
5400	1334.3	20	125.3	2.82	8.8	-8.5	16.8	-15.4	13.5	-13.5	-24.7	24.0	23	-21	10	7

SARPA-FR (OT) 2768 Dec 75

Table A-5

M102 howitzer, 105mm, firing M548

Basic Projectile: M548, Fuze M557 — Charge: 3 (195.1 m/s)

Source: FT 105-AU-1 — Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	137.2	7	2.1	0.07	10.7	-9.2	0.2	-0.2	0.0	0.0	-0.3	0.3	-17	18	7	1
2000	297.6	6	5.0	0.15	20.6	-17.9	0.7	-0.6	0.0	0.0	-1.3	1.4	-32	33	14	2
3000	529.2	3	10.1	0.22	29.6	-26.0	1.8	-1.4	0.0	0.0	-3.0	3.1	-44	45	21	3
3300	661.3	2	13.9	0.33	29.6	-28.3	2.2	-1.8	0.0	0.0	-3.7	3.9	-47	48	21	3
3000	1036.1	3	34.4	0.59	29.3	-25.3	2.2	-1.9	0.0	0.0	-3.8	3.8	-41	42	22	5
2000	1262.8	6	92.7	1.26	20.0	-17.6	1.7	-1.1	0.0	0.0	-1.4	1.6	-24	26	14	4
1721	1305.0	6	131.1	1.44	18.3	-17.0	1.0	-1.1	0.0	0.0	-1.4	1.3	-23	24	14	4

SARPA-FR (OT) 2768 Dec 75

Table A-5 (continued)

Basic Projectile: M548, Fuze M557   Charge: 4 (245.1 m/s)

Source: FT 105-AU-1   Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	86.2	11	1.2	0.05	8.4	-7.5	0.1	-0.1	0.0	0.0	-0.3	0.3	-15	16	6	0
2000	181.2	10	2.7	0.11	16.[illegible]	-14.5	0.5	-0.5	0.0	0.0	-1.2	1.2	-27	28	11	1
3000	291.2	8	4.7	0.18	23.4	-21.1	1.2	-1.1	0.0	0.0	-2.9	2.9	-39	40	17	2
4000	430.7	6	7.5	0.25	30.2	-27.2	2.3	-1.9	0.0	0.0	-5.0	5.1	-48	49	22	2
5000	695.1	2	14.7	0.39	34.5	-33.0	3.8	-3.2	0.0	0.0	-7.9	7.9	-54	55	29	4
4000	1127.3	6	44.0	0.77	29.3	-26.2	4.3	-2.9	0.0	0.0	-6.9	6.9	-41	43	23	4
3000	1265.7	9	81.5	1.22	22.3	-20.1	3.3	-1.9	0.0	0.0	-4.4	4.6	-29	31	17	4
2374	1330.	11	158.6	1.69	18.5	-17.9	1.6	-1.9	0.0	0.0	-3.4	2.6	-20	22	17	3

SARPA-FR (OT) 2768 Dec 75

Table A-5 (continued)

Basic Projectile: M548, Fuze M557 Charge: 5 (307.8 m/s)

Source: FT 105-AU-1 Also Currently Used for Shell: ________

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
1000	54.5	18	0.6	0.04	6.5	-5.8	0.4	-0.1	0.6	-0.1	-0.3	0.3	-12	13	6	0
2000	[illegible]	16	1.5	0.09	12.5	-11.0	1.3	-0.4	1.6	-0.2	-1.3	1.3	-22	23	9	1
3000	177.9	15	2.5	0.13	18.2	-16.0	2.3	-0.9	2.5	-0.3	-2.8	2.8	-30	32	13	2
4000	250.5	13	3.8	0.18	23.5	-20.8	3.3	-1.5	3.1	-0.4	-4.8	4.9	-37	38	17	2
5000	334.8	11	5.3	0.24	28.5	-25.3	4.5	-2.4	3.6	-0.5	-7.4	7.6	-41	43	22	3
6000	439.6	8	7.4	0.30	33.3	-29.6	5.8	-3.4	3.9	-0.5	-10.5	10.8	-44	46	27	4
7000	597.6	4	11.4	0.39	37.7	-33.8	7.6	-4.7	3.9	-0.5	-14.2	14.8	-45	48	33	5
7300	689.7	3	14.2	0.44	[illegible]	-35.0	7.6	-5.2	3.8	-0.5	-15.6	16.0	-45	47	33	5
7000	952.1	4	26.5	0.61	37.6	-33.6	7.7	-6.5	3.3	-0.4	-16.5	16.5	-40	43	35	6
6000	1110.1	4	40.8	0.81	32.5	-29.0	7.4	-5.7	2.7	-0.3	-13.9	14.0	-34	37	30	6
5000	1215.4	11	59.0	1.03	27.3	-24.4	[illegible]	-3.8	2.2	-0.3	-11.1	[illegible]	-28	30	24	6
4000	1298.7	13	95.0	1.48	22.2	-19.8	5.2	-3.2	[illegible]	-0.3	-7.9	8.3	-20	22	19	5
3223	1350.0	16	168.5	1.88	18.7	-17.3	3.2	-3.2	1.7	-0.3	-6.7	5.5	-10	12	19	5

SARPA-FP (OT) 2768 Dec 75

Table A-5 (continued)

Basic Projectile: M548, Fuze M557 Charge: 6 (429.2 m/s)

Source: FT 105-AU-1 Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	29.6	31	0.6	0.08	4.5	-4.2	0.2	-0.4	-0.1	0.1	-0.8	0.8	-10	10	7	0
2000	65.1	26	1.4	0.18	8.1	-7.8	0.7	-0.7	-0.4	-0.1	-3.2	3.2	-14	14	8	1
3000	107.1	22	2.3	0.26	10.5	-10.3	2.0	-2.0	1.1	-2.6	-6.0	5.7	-15	16	10	1
4000	154.5	20	3.2	0.32	12.1	-12.0	3.8	-3.6	5.0	-6.4	-8.4	8.2	-14	15	13	2
5000	207.2	18	4.2	0.37	13.5	-13.3	6.0	-5.4	9.5	-10.6	-11.1	11.1	-11	12	15	3
6000	266.0	16	5.3	0.42	14.7	-14.5	8.4	-7.4	14.0	-14.5	-14.7	14.5	-7	9	17	3
7000	332.8	14	6.7	0.48	15.9	-15.7	10.8	-9.3	18.1	-18.1	-18.6	18.6	-2	4	21	4
8000	411.4	12	8.5	0.54	17.2	-16.8	13.4	-11.3	21.6	-21.2	-23.0	23.2	5	-2	24	5
9000	511.2	8	11.0	0.61	18.5	-18.1	16.2	-13.3	24.4	-23.9	-28.0	28.7	13	-10	29	6
10000	680.6	3	17.8	0.75	20.1	-19.5	16.9	-15.3	26.0	-26.0	-33.9	34.6	23	-19	34	7
10100	717.9	3	17.8	0.75	20.1	-19.7	16.9	-15.5	26.0	-26.2	-34.6	34.6	24	-20	34	7
10000	882.7	3	25.9	0.91	20.1	-19.7	16.9	-16.3	26.0	-24.7	-37.9	34.6	27	-23	37	8
9000	1045.9	9	38.9	1.12	18.8	-18.0	17.6	-14.9	22.9	-22.1	-34.3	33.6	26	-22	34	9
8000	1140.5	12	51.3	1.32	16.9	-16.2	16.5	-13.2	20.3	-19.7	-30.3	29.9	24	-20	30	9
7000	1214.1	15	67.2	1.58	14.8	-14.1	15.2	-10.8	18.0	-17.5	-26.0	25.9	23	-19	26	8
6000	1275.3	18	92.6	1.96	12.6	-11.9	13.6	-7.3	15.9	-15.6	-21.4	21.6	24	-21	22	8
5000	1325.7	23	150.5	2.85	10.0	-9.9	11.4	-7.3	14.6	-14.5	-17.0	16.7	33	-29	19	7

SARPA-FR (MT) 2768 Dec 75

Table A-5 (continued)

Basic Projectile: M548, Fuze M557 | Charge: 7 (548.6 m/s)

Source: FT 105-AU-1 | Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std. 2 Sq		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	39.1	43	1.0	0.13	6.6	-6.3	0.4	-0.4	-0.6	0.5	-3.0	3.1	-14	15	10	1
4000	94.9	30	2.6	0.29	11.3	-11.0	2.0	-1.8	-2.1	1.5	-11.3	11.6	-11	13	12	2
6000	173.8	22	4.6	0.43	14.1	-13.9	5.2	-4.5	0.7	-2.7	-20.7	19.9	-2	4	17	3
7000	221.3	20	5.7	0.49	15.1	-14.9	7.3	-6.2	4.3	-6.1	-24.7	23.8	3	-1	19	4
8000	274.6	18	7.0	0.55	16.0	-15.7	9.7	-8.1	8.4	-9.7	-28.8	28.0	9	-7	21	4
9000	334.6	16	8.5	0.60	16.8	-16.5	12.2	-10.1	12.4	-13.2	-33.3	32.8	17	-13	24	5
10000	404	13	10.3	0.66	17.6	-17.3	15.0	-12.2	15.9	-16.4	-38.3	38.2	25	-21	26	6
11000	488.1	11	12.7	0.73	18.5	-18.1	18.1	-14.3	19.0	-19.2	-43.9	44.5	35	-31	30	7
12000	604.5	7	16.4	0.82	19.6	-19.1	20.2	-16.6	21.4	-21.6	-50.3	52.9	47	-42	33	8
12600	759.7	3	22.8	0.89	20.1	-19.8	20.2	-18.0	22.0	-22.8	-54.7	52.9	56	-51	36	9
12000	960.8	7	35.8	1.18	19.8	-19.2	20.2	-20.5	20.9	-21.3	-58.4	55.0	60	-55	38	11
11000	1066.6	12	46.9	1.37	18.4	-17.8	21.6	-19.4	19.0	-19.4	-53.7	52.2	57	-52	35	11
10000	1140.8	15	58.6	1.56	16.9	-16.2	21.0	-18.0	17.3	-17.8	-48.7	47.8	54	-49	32	11
9000	1200.8	18	72.9	1.79	15.2	-14.6	20.1	-16.0	15.8	-16.3	-43.4	42.9	52	-47	28	11
7000	1294.8	26	130.4	2.66	11.2	-10.6	17.4	-11.8	13.7	-14.2	-31.3	32.1	57	-52	21	9
6146	1325.	31	189.4	3.04	9.1	-8.8	15.4	-11.8	13.8	-14.4	-27.6	26.8	69	-64	21	9

SARPA-FR (UT) 2768 Dec 75

Table A-5 (continued)

Basic Projectile: M548, Fuze M557　　Charge: 7 RA (548.6 m/s)

Source: FT 105-AU-1　　Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 2 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
meters	mils	meters	mils	mils											meters	meters
2000	38.9	[illegible]	1.1	0.12	6.6	-6.3	0.4	-0.4	-0.6	0.5	-2.9	3.0	-14	15	10	1
4000	94.0	30	2.9	0.28	11.4	-11.0	1.9	-1.7	-2.1	1.6	-11.1	11.4	-12	13	12	2
6000	171.4	23	5.1	0.41	14.6	-14.2	4.9	-4.4	0.2	-2.2	-20.6	20.0	-3	5	17	3
8000	259.9	21	7.6	0.47	17.1	-16.8	9.0	-7.6	7.4	-9.4	-29.5	27.8	2	0	24	4
10000	360.4	18	10.4	0.53	18.1	-17.9	14.2	-11.7	18.5	-19.2	-36.2	33.9	8	-5	28	6
12000	479.9	15	13.7	0.60	18.4	-18.3	20.2	-16.1	31.0	-29.5	-42.5	40.6	15	-12	32	7
14000	636.5	10	18.7	0.66	18.4	-18.3	26.8	-21.0	41.2	-38.0	-50.0	50.4	25	-21	38	10
15300	852.9	3	28.0	0.72	18.9	-18.2	26.8	-24.2	43.2	-39.6	-56.6	58.7	29	-2	44	11
14000	1083 2	13	46.4	0.92	19.4	-18.4	26.8	-21.3	30.9	-21.8	-63.1	63.6	12	-8	68	14
12000	1201.6	21	65.5	1.10	16.9	-16.0	23.0	-17.8	21.1	-17.4	-54.6	55.7	4	-1	65	14
10000	1284.9	27	91.7	1.38	13.6	-12.9	19.5	-12.7	16.2	-14.4	-44.2	45.4	4	-1	58	13
8000	1349.5	36	149.2	2.04	9.6	-8.7	15.2	-11.5	13.4	-12.1	-32.8	33.8	14	-10	54	12
6985	1375.0	44	220.8	2.33	6.5	-6.0	11.6	-11.5	12.7	-11.8	-32.8	26.1	28	-24	54	10

SARPA-FR (OT) 2768 Dec 75

Table A-6

XM204 howitzer, 105mm, firing M1

Basic Projectile: M1   Page 1 of 2

Source: Computer Simulations   Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M67 1	300	2206		5.1												
"	800	3729		18.5												
"	1155.6	2818		43.2												
M67 2	300	2625		5.1												
"	800	4396		18.5												
"	1155.6	3325		43.5												
M67 3	300	3139		5.1												
"	900	5232		18.5												
"	1155.6	3938		43.8												
M67 4	300	4100		5.0												
"	800	6676		18.5												
"	1155.6	5065		44.1												

SARPA-FR (OT) 2709 Dec 75

Table A-6 (continued)

Basic Projectile: M1 Page 2 of 2

Source: Computer Simulations Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 ___		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M67 5	300	5201		5.2												
"	800	8380		19.0												
"	1155.6	6395		45.5												
[illegible] 6	300	6111		6.3												
"	800	9748		21.5												
"	1155.6	7505		50.7												
M67 7	300	7506		7.5												
"	800	11540		25.[illegible]												
"	1155.6	8935		57.9												

SARPA-FR (OT) 2769 Dec 75

Table A-7

M109 howitzer, 155mm, firing M107

Basic Projectile: M107, Fuze M557 Charge: 1G (207.3 m/s)

Source: FT-155-AH-3 Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	120.3	3	2.1	0.05	10.1	-8.8	0.1	-0.0	0.0	0.0	-0.3	0.3	-10	11	7	1
2000	255.4	7	5.0	0.11	19.6	-17.1	0.5	-0.4	0.0	0.0	-1.0	1.0	-20	20	13	1
3000	424.7	5	9.0	0.17	28.7	-25.2	1.2	-1.0	0.0	0.0	-2.2	2.3	-28	29	20	2
3900	729.2	2	19.2	0.27	33.1	-32.1	2.1	-1.7	0.0	0.0	-3.7	3.6	-34	35	24	3
3000	1141.4	5	59.2	0.67	28.7	-25.5	1.4	0.6	0.0	0.0	-2.0	2.2	-26	27	20	4
2257	1250.0	8	136.1	1.15	23.3	-22.6	-0.9	0.6	0.0	0.0	-0.3	-0.2	-18	19	17	3

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 — Charge: 2G (236.2 m/s)

Source: FT-155-AH-3 — Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	92.3	10	1.6	0.05	8.8	-7.8	0.1	-0.1	0.0	0.0	-0.3	0.3	-10	11	6	1
2000	193.[illegible]	9	3.7	0.10	17.1	-15.2	0.5	-0.4	0.0	0.0	-1.0	1.1	-20	20	12	1
3000	309.5	8	6.3	0.15	24.9	-22.2	1.0	-0.9	0.0	0.0	-2.3	2.3	-28	29	18	2
4000	457.[illegible]	6	[illegible]0.1	0.21	32.4	-29.0	1.8	-1.5	0.0	0.0	-3.9	4.0	-35	36	24	3
4900	710.1	2	18.9	0.30	36.1	-34.9	3.0	-2.4	0.0	0.0	-5.8	5.7	-41	42	25	3
4000	1110.3	6	51.9	0.60	32.3	-28.9	2.6	-0.3	0.0	0.0	-4.2	4.4	-32	34	25	5
3000	1241.5	10	111.3	1.30	25.3	-23.4	0.4	0.7	0.0	0.0	-0.8	1.5	-22	24	17	4
2682	1270.	11	161.7	1.30	23.6	-23.4	-1.6	0.7	0.0	0.0	-0.8	-0.3	-22	20	17	4

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557

Charge: 3G (275.8 m/s)

Also Currently Used for Shell: M110, M116, M121A1

Source: FT-155-AH-3

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
1000	67.3	14	1.1	0.04	7.5	-6.7	0.1	-0.1	0.0	0.0	-0.2	0.2	-10	11	4	1
2000	139.3	13	2.6	0.07	14.6	-13.2	0.4	-0.3	0.0	0.0	-0.9	1.0	-20	20	7	1
3000	218.2	12	4.3	0.11	21.3	-19.3	0.8	-0.7	0.0	0.0	-2.1	2.1	-28	29	11	2
4000	307.6	10	6.4	0.15	27.7	-25.2	1.4	-1.2	0.0	0.0	-3.7	3.7	-36	37	15	2
5000	415.7	8	9.1	0.20	33.9	-30.8	2.3	-1.9	0.0	0.0	-5.6	5.7	-42	44	21	3
6000	568.9	5	13.8	0.26	37.7	-36.3	2.5	-2.8	0.0	0.0	-8.1	[illegible]	-48	50	27	4
6500	739.3	2	20.6	0.31	40.3	-38.9	4.1	-3.4	0.0	0.0	-9.6	9.6	-50	51	31	5
6000	992.6	5	37.5	0.49	39.6	-35.8	4.4	-3.3	0.0	0.0	-9.2	9.3	-45	47	29	6
5000	1141.3	9	58.8	0.70	33.4	-30.3	3.7	-0.9	0.0	0.0	-6.9	[illegible]	-37	39	23	6
4000	1239.2	12	100.1	1.18	27.4	-25.3	1.5	1.2	0.1	0.0	-3.4	4.1	-27	29	15	5
3420	1280.0	15	152.2	1.52	24.9	-24.1	-0.7	1.2	0.1	-0.1	-2.3	1.5	-20	23	15	5

SARPA-FR (OT) 2763 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 Charge: 4G (317.0 m/s)

Source: FT-155-AH-3 Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	51.1	19	0.8	0.04	6.2	-5.1	0.7	-0.1	1.8	-0.3	-0.3	0.3	[illegible]	10	5	1
2000	105.5	18	1.9	0.07	11.9	-9.4	2.1	-0.4	4.7	-0.7	-1.0	1.0	-17	18	6	1
3000	164.1	16	3.2	0.10	17.4	-13.6	3.6	-0.9	7.4	-1.1	-2.2	2.3	-25	25	9	2
4000	278.2	15	4.6	0.14	22.6	-17.7	5.0	-1.4	9.6	-1.3	-3.9	3.9	-29	32	12	2
5000	300.0	13	6.2	0.18	27.7	-21.8	6.3	-2.1	11.3	-1.6	-5.9	6.0	-35	38	16	3
6000	383.5	11	8.3	0.22	32.7	-26.0	7.6	-2.8	12.5	-1.7	-8.3	8.5	-39	44	21	4
7000	488.2	8	11.2	0.27	37.5	-30.1	8.7	-3.7	13.2	-1.8	-11.1	11.3	-44	49	27	5
8000	658.5	3	17.1	0.34	41.5	-34.5	9.2	-4.9	13.1	-1.8	-14.3	14.9	-48	53	34	6
8200	744.1	2	20.8	0.35	41.5	-35.4	9.2	-5.1	13.1	-1.7	-15.1	14.9	-48	53	34	6
8000	907.7	3	30.3	0.47	41.5	-35.6	9.2	-5.6	12.0	-1.5	-15.4	15.3	-47	52	36	7
7000	1073.7	8	46.6	0.61	37.7	-31.6	7.6	-4.3	9.9	-1.3	-12.9	13.1	-41	46	31	8
6000	1173.1	12	65.3	0.79	32.8	-27.5	6.0	-1.4	8.5	-1.1	-10.0	10.4	-34	39	25	7
5000	1247.5	16	99.5	1.18	27.9	-23.3	3.5	0.1	7.5	-1.0	-6.1	7.1	-26	30	17	7
4125	1295.0	21	169.8	1.64	24.7	-21.1	3.5	0.1	7.3	-1.2	-3.9	2.6	-14	19	17	6

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 Charge: 5G (374.9 m/s)

Source: FT-155-AH-3 Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	51.1	19	0.8	0.04	6.2	-5.1	0.7	-0.1	1.8	-0.3	-0.3	0.3	-9	10	5	1
2000	105.5	18	1.9	0.07	11.9	-9.4	2.1	-0.4	4.7	-0.7	-1.0	1.0	-17	18	6	1
3000	164.1	16	3.2	0.10	17.4	-13.6	3.6	-0.9	7.4	-1.1	-2.2	2.3	-23	26	9	2
4000	228.2	15	4.6	0.14	22.6	-17.7	5.0	-1.4	9.6	-1.3	-3.9	3.9	-29	32	12	2
5000	300.0	13	6.2	0.18	27.7	-21.8	6.3	-2.1	11.3	-1.6	-5.9	6.0	-35	38	16	3
6000	383.5	11	8.3	0.22	32.7	-26.0	7.6	-2.8	12.5	-1.7	-8.3	8.5	-39	44	21	4
7000	488.2	8	11.2	0.27	37.5	-30.1	8.7	-[illegible].7	13.2	-1.8	-11.1	11.3	-44	49	27	5
8000	658.5	3	17.1	0.34	41.5	-34.5	9.2	-4.9	13.1	-1.8	-14.3	14.9	-48	53	34	6
8400	744.1	2	20.8	0.35	41.5	-35.4	9.2	-5.1	13.1	-1.7	-15.1	14.9	-48	53	34	6
8000	907.7	3	30.3	0.47	41.5	-35.6	9.2	-5.6	12.0	-1.5	-15.4	15.3	-47	52	36	7
7000	1073.7	8	46.6	0.61	37.7	-31.6	7.6	-4.3	9.9	-1.3	-12.9	13.1	-41	46	31	8
6000	1173.1	12	65.3	0.79	32.8	-27.5	6.0	-[illegible].4	3.5	-1.1	-10.0	10.4	-34	39	25	7
5000	1247.5	16	99.5	1.18	27.9	-25.3	3.5	0.1	7.5	-1.0	-6.1	7.1	-26	30	17	7
4125	1295.0	21	169.6	1.64	24.7	-22.1	-0.5	0.1	7.3	-1.2	-3.9	2.6	-14	19	17	6

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 — Charge: 3W (269.7 m/s)

Source: FT-155-AH-3 — Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	70.4	14	1.2	0.04	7.7	-6.9	0.1	-0.1	0.0	0.0	-0.2	0.2	-7	7	8	1
2000	145.9	13	2.7	0.07	14.9	-13.4	0.4	-0.3	0.0	0.0	-0.9	1.0	-12	13	15	1
3000	226.9	11	4.5	0.11	21.8	-19.7	0.8	-0.7	0.0	0.0	-2.1	2.1	-17	18	22	2
4000	324.0	10	6.8	0.16	28.4	-25.7	1.4	-1.3	0.0	0.0	-3.7	3.7	-22	22	29	3
5000	441.4	7	9.9	0.21	34.7	-31.5	2.3	-2.0	0.0	0.0	-5.6	5.8	-25	26	36	3
6000	625.	3	15.8	0.28	39.5	-37.1	3.7	-2.9	0.0	0.0	-8.1	8.4	-28	28	44	5
6200	700.7	3	18.8	0.31	39.5	-36.1	3.7	-3.2	0.0	0.0	-8.7	8.7	-28	23	44	5
6000	937.5	3	32.7	0.45	39.5	-36.7	4.2	-3.4	0.0	0.0	-9.0	9.0	-26	27	45	6
5000	1117.2	8	54.0	0.64	34.2	-31.0	3.7	-1.4	0.0	0.0	-6.8	7.1	-21	22	37	6
4000	1225.4	11	90.8	1.06	[illegible]	-25.7	1.8	0.4	0.0	0.0	-3.7	4.3	-14	16	29	5
3275	1280.0	15	165.7	1.48	24.8	-24.1	-1.5	[illegible]	0.1	-0.1	-1.6	0.7	-7	8	29	5

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 | Charge: 4W (313.9m/s)

Source: FT-155-AH-3 | Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	52.1	19	0.8	0.03	6.4	-5.3	0.7	-0.1	1.5	-0.2	-0.3	0.3	-7	7	7	1
2000	107.5	17	2.0	0.07	12.3	-10.3	1.9	-0.4	3.8	-0.4	-1.0	1.0	-13	13	11	1
3000	167.2	16	3.3	0.10	18.0	-14.6	3.2	-0.8	5.9	-0.6	-2.2	2.2	-17	19	16	2
4000	232.7	14	4.7	0.14	23.4	-19.1	4.5	-1.3	7.5	-0.8	-3.8	3.9	-22	23	21	2
5000	305.2	13	6.4	0.18	28.6	-23.5	5.7	-1.9	8.8	-0.9	-5.9	6.0	-25	27	27	3
6000	392.3	11	8.5	0.22	33.7	-27.9	6.8	-2.7	9.7	-1.0	-8.3	8.4	-28	30	33	4
7000	501.9	8	11.5	0.27	38.5	-32.2	7.9	-3.6	10.2	-1.0	-11.1	11.3	-30	33	40	5
8000	700.8	3	18.8	0.35	41.6	-36.7	8.3	-4.8	10.0	-1.0	-14.3	14.5	-32	35	48	6
9000	1060.3	8	44.8	0.59	38.7	-33.2	7.2	-4.2	7.6	-0.7	-12.8	13.0	-27	30	43	8
[illegible]	1164.7	11	63.1	0.77	33.6	-28.8	5.7	-1.9	6.5	-0.7	-9.9	10.4	-22	25	36	7
[illegible]	1242.2	15	95.6	1.13	28.5	-24.6	3.4	0.4	5.7	-0.6	-5.2	7.1	-16	18	29	7
[illegible]	1295.	21	175.3	1.69	25.3	-21.9	-1.2	0.4	5.5	-0.7	-3.4	2.1	-5	7	25	6

SARPA-FR (JT) 1758 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 Charge: 5W ([illegible]73.4 m/s)

Source: FT-155-AH-3 Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	38.6	24	0.8	0.08	5.0	-4.8	0.2	-0.4	0.1	-0.6	-0.7	0.7	-6	6	7	1
2000	82.8	22	1.9	0.15	8.0	-8.1	1.2	-1.7	2.0	-3.8	-2.1	2.0	-8	9	10	2
3000	131.2	20	3.0	0.19	10.0	-10.2	3.0	-3.4	6.6	-8.4	-3.6	3.5	-9	10	12	2
4000	183.5	18	4.1	0.23	11.7	-11.9	5.2	-5.2	12.0	13.2	-5.4	5.2	-9	10	14	2
5000	240.3	17	5.4	0.27	13.4	-13.4	7.5	-7.1	17.3	-17.7	-7.4	7.4	-9	10	16	3
6000	302.8	15	6.9	0.30	15.1	-15.0	9.7	-8.9	22.0	-21.8	-10.2	10.1	-8	9	19	3
7000	373.7	13	8.7	0.34	17.1	-16.6	11.8	-10.6	26.0	-25.3	-13.2	13.2	-7	8	23	4
8000	457.9	11	10.9	0.38	19.2	-18.5	13.8	-12.2	29.2	-28.3	-16.7	16.8	-5	7	27	5
9000	570.0	7	14.4	0.43	21.7	-20.6	15.5	-13.7	31.6	-30.8	-20.6	21.0	-4	5	32	6
9800	778.8	2	22.9	0.50	23.3	-22.6	15.5	-14.8	31.9	-32.1	-24.2	23.5	-2	4	34	7
9000	1005.3	8	38.9	0.71	23.2	-22.1	15.3	-11.2	28.9	-27.1	-23.4	23.2	-1	3	37	9
8000	1110.9	11	52.5	0.83	21.0	-19.8	13.1	-8.6	25.5	-24.2	-20.1	20.2	0	2	31	9
7000	1187.5	15	69.7	1.07	18.5	-17.3	11.0	-4.6	22.7	-21.8	-16.4	16.8	2	0	26	9
6000	1247.4	19	99.7	1.45	15.6	-14.4	8.2	-3.1	20.7	-20.1	-11.6	12.8	7	-5	20	8
5040	1290.0	26	162.5	1.94	12.3	-11.5	3.2	-3.4	20.4	-20.3	-9.8	7.3	19	-17	20	7

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 Charge: 6W (461.8 m/s)

Source: FT-155-AH-3 Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	53.8	32	1.4	0.13	8.1	-7.6	0.4	-0.4	-0.8	0.7	-2.6	2.7	-12	12	10	1
4000	126.5	24	3.5	0.27	13.8	-13.4	2.0	-2.0	-1.7	-0.5	-9.2	9.0	-15	16	15	2
6000	218.8	20	6.0	0.37	16.8	-16.7	5.7	-5.2	5.5	-8.0	-15.1	14.3	-15	16	19	3
8000	329.3	16	9.0	0.4[illegible]	19.1	-18.9	10.3	-9.0	15.2	-16.5	-21.1	20.5	-12	13	22	5
10000	469.4	12	13.1	0.52	21.6	-21.2	15.1	-12.9	23.1	-23.6	-28.8	28.8	-7	9	27	6
12000	746.2	3	23.8	0.66	24.7	-24.1	17.9	-16.5	27.1	-28.6	-39.0	37.8	0	3	33	9
12000	848.3	3	29.5	0.76	24.7	-24.6	17.9	-16.5	27.1	-27.4	-42.1	37.8	1	2	35	10
10000	1105.3	14	56.1	1.07	21.7	-20.9	16.8	-12.6	22.1	-22.8	-34.4	34.0	4	-1	29	11
8000	1221.6	22	91.8	1.54	17.0	-16.2	13.2	-5.1	19.0	-19.8	-24.6	25.4	11	-9	2[illegible]	10
6293	1285.0	35	184.6	2.25	11.2	-10.6	5.6	-5.1	18.9	-20.7	-19.2	16.0	23	-29	20	8

SARPA-FR (OT) 2768 Dec 75

Table A-7 (continued)

Basic Projectile: M107, Fuze M557 — Charge: 7W (562.4 m/s)

Source: FT-155-AH-3 — Also Currently Used for Shell: M110, M116, M121A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	35.6	50	1	.09	6.7	-6.4	.3	-.3	-.7	.7	-2.3	2.4	-15	16	11	1
4000	82.2	37	2.5	.20	12.2	-11.7	1.2	-1.1	-2.7	2.5	-9.0	9.4	-22	23	14	2
6000	145.3	27	4.6	.33	16.3	-15.9	3.2	-2.8	-5.1	3.4	-19.4	19.4	-21	22	19	3
8000	227.6	22	7.3	.44	18.9	-18.6	6.6	-5.7	-1.6	-1.8	-28.6	27.1	-19	20	24	4
10000	327.7	18	10.5	.53	20.9	-20.6	11.1	-9.4	6.8	-9.4	-35.1	34.5	-15	18	29	5
12000	451.6	14	14.6	.61	22.7	-22.4	16.1	-13.3	15	16.5	-44.4	43.8	-10	13	34	7
14000	636.6	7	21.7	.71	25.3	-24.7	20.5	-17.3	20.2	-21.7	-55.3	57.7	-2	5	40	9
14600	772.5	3	28.4	.76	25.9	-25.6	20.5	-18.6	20.5	-22.6	-59.4	57.7	2	2	42	10
14000	958.9	8	42.3	.93	25.9	-25.4	20.5	-19.5	19.2	-20.7	-62.4	59.	5	0	44	12
12000	1116.5	16	64.9	1.27	22.6	-21.9	20.3	-15.7	16.2	-17.9	-52.6	51.9	9	-4	38	12
10000	1209.5	26	98.7	1.70	18.3	-17.3	17.2	-10.1	14.8	-16.6	-40.4	41.6	20	-15	29	11
7963	1270.	45	191.9	2.47	11.3	-14.3	9.3	-10.1	15.8	-19.1	-33.2	26.4	38	-51	29	10

SARPA-FR (OT) 2768 Dec 75

Table A-8

M109 howitzer, 155mm, firing M549

Basic Projectile: M549, Fuze M557

Charge: 1G (208.8 m/s)

Source: FT 155-AL-0

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
1000	118.0	8	1.5	.04	10.1	-8.8	.1	-.1	0	0	-.2	.2	-12	13	5	0
2000	249.2	7	3.5	.09	19.6	-17.1	.5	-.4	0	0	-.9	.9	-24	24	9	1
3000	411.4	5	6.4	.15	28.7	-25.2	1.0	-.9	0	0	-2.0	2.0	-34	34	14	1
4000	753.6	1	15.1	.24	33.9	-32.9	1.9	-1.7	0	0	-3.7	3.6	-42	42	21	2
3000	1160.0	5	46.4	.59	28.2	-24.7	2.0	-.5	0	0	-2.6	2.7	-31	31	15	3
2119	1295.0	7	115.8	1.09	21.3	-20.4	.5	-.5	0	0	-1.1	1.1	-21	22	12	3

SARPA-FR (OT) 2768 Dec 75

Table A-8 (continued)

B·sic Projectile: M549, Fuze M557 Charge: 2G (236.2 m/s)

Source: FT 155-AL-0 Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	91.9	11	1.1	.04	8.8	-7.8	.1	-.1	0	0	-.2	.2	-15	15	4	0
2000	191.5	9	2.6	.08	17.2	-15.3	.4	-.4	0	0	-.9	.9	-29	29	8	1
3000	305.3	8	4.4	.13	25.2	-22.4	.9	-.8	0	0	-2.0	2.0	-41	42	13	1
4000	448.7	6	7.0	.13	32.8	-29.3	1.7	-1.4	0	0	-3.5	3.6	-52	53	18	2
5000	764.1	2	15.3	.25	37.1	-35.9	2.7	-2.4	0	0	-5.7	5.6	-61	62	25	3
4000	1120.3	6	38.9	.55	32.2	-28.6	2.9	-1.7	0	0	-4.6	4.7	-48	49	20	4
3000	1259.8	9	78.1	.94	24.6	-22.0	1.9	-.6	0	0	-2.6	2.9	-35	37	14	4
2523	1310.0	10	126.0	1.27	21.7	-20.9	.7	-.6	0	0	-2.0	1.7	-30	31	14	4

SARPA-FR (OT) 2788 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557   Charge: 3G (274.3 m/s)

Source: FT 155-AL-0   Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	67.9	14	.7	.03	7.5	-6.8	.1	-.1	0	0	-.2	.2	-14	15	4	0
2000	140.4	13	1.8	.07	14.7	-13.3	.3	-.3	0	0	-.9	.9	-27	28	7	1
3000	219.7	12	2.9	.11	21.5	-19.5	.8	-.7	0	0	-2.0	2.0	-39	40	11	1
4000	309.5	10	4.4	.15	28.0	-25.4	1.4	-1.2	0	0	-2.5	3.5	-50	51	15	2
5000	418.0	8	6.3	.19	34.2	-31.1	2.2	-1.9	0	0	-3.4	5.5	-59	61	20	2
6000	572.5	5	9.6	.25	40.1	-36.6	3.4	-2.8	0	0	-7.8	8.0	-68	69	26	3
6500	758.6	2	14.9	.30	40.7	-39.3	3.7	-3.4	0	0	-9.3	9.4	-71	72	30	4
6000	992.8	5	26.4	.46	39.9	-36.0	4.5	-3.8	0	0	-9.2	9.2	-64	65	29	4
5000	1146.7	8	41.8	.62	33.5	-30.3	4.1	-2.6	0	0	-7.3	7.4	-53	55	23	5
4000	1253.0	11	68.6	.90	27.1	-24.6	3.1	-1.0	0	0	-5.1	5.3	-42	44	17	5
3121	1325.0	13	136.3	1.34	22.3	-21.5	1.2	-1.0	0	0	-3.5	2.9	-31	33	14	5

SARPA-FR (OT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557   Charge: 5G (370.3 m/s)

Source: FT 155-AL-0   Also Currently Used for Shell: ______

Basic		Elev Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	38.6	24	.5	.06	5.1	-4.9	.2	-.3	0	-.5	-.6	.6	-12	12	6	0
2000	81.7	22	1.3	.12	8.6	-8.6	.9	-1.4	1.3	-3.2	-1.8	1.8	-19	19	7	1
3000	125.7	20	2.0	.16	11.0	-11.2	2.4	-2.9	5.0	-7.2	-3.3	3.1	-23	23	8	1
4000	179.4	19	2.7	.20	13.1	-13.2	4.3	-4.6	9.7	-11.5	-4.9	4.8	-25	26	10	2
5000	234.2	17	3.6	.23	15.1	-15.1	6.4	-6.3	14.6	-15.6	-7.0	6.9	-27	28	13	2
6000	294.3	16	4.5	.26	17.2	-17.0	8.5	-7.9	18.9	-19.3	-9.4	9.3	-29	29	16	3
7000	364.8	14	5.7	.29	19.4	-18.9	10.5	-9.5	22.6	-22.4	-12.2	12.3	-30	31	19	3
8000	441.0	11	7.2	.33	21.9	-21.0	12.4	-11.0	25.5	-25.1	-15.5	15.6	-30	32	24	4
9000	542.8	8	9.4	.38	24.6	-23.4	14.1	-12.4	27.6	-27.1	-19.2	19.5	-31	33	28	4
10000	753.1	3	15.6	.45	27.1	-26.1	14.3	-13.6	28.0	-28.4	-23.5	22.9	-32	34	34	5
9000	1030.8	8	30.8	.66	26.3	-25.0	13.8	-10.7	24.2	-23.0	-22.6	22.4	-30	32	33	7
8000	1129.5	12	41.2	.79	23.8	-22.5	12.2	-9.1	21.2	-20.3	-19.8	19.7	-27	28	29	7
7000	1205.5	15	54.5	.95	21.1	-19.8	10.6	-6.9	18.5	-17.9	-16.8	16.9	-23	24	25	7
6000	1268.9	17	76.6	1.20	18.1	-17.0	9.0	-5.2	16.2	-15.7	-13.4	13.8	-18	19	20	8
5000	1321.8	21	129.5	1.82	14.9	-13.9	6.5	-5.2	14.3	-14.1	-10.6	10.1	-10	10	18	7
4707	1335.0	22	149.4	1.82	14.2	-13.5	5.8	-5.2	14.1	-14.0	-10.6	9.1	-7	7	18	7

SARPA-FR (OT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557 — Charge: 3W (266.7 m/s)

Source: FT 155-AL-0 — Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	71.9	14	.8	.03	7.8	-7.0	.1	-.1	0	0	-.2	.2	-13	14	6	0
2000	148.8	12	1.9	.07	15.1	-13.6	.4	-.3	0	0	-.9	.9	-25	26	10	1
3000	233.3	11	3.2	.11	22.2	-20.0	.8	-.7	0	0	-2.0	2.0	-36	37	15	1
4000	330.3	9	4.7	.15	28.9	-26.1	1.4	-1.2	0	0	-3.5	3.5	-46	47	20	1
5000	451.0	7	6.9	.20	35.3	-32.0	2.3	-1.9	0	0	-5.4	5.5	-54	55	26	2
6000	649.3	3	11.6	.28	39.5	-37.6	3.8	-2.9	0	0	-7.9	8.2	-61	63	32	2
6100	689.3	3	12.7	.29	[illegible]	-38.4	3.8	-3.0	0	0	-8.2	8.6	-62	63	32	2
6000	916.8	3	21.8	.41	39.5	-37.1	3.9	-3.7	0	0	-8.8	8.8	-59	61	34	3
5000	1114.6	7	37.6	.57	34.6	-31.2	4.0	-2.8	0	0	-7.1	7.2	-49	51	28	3
4000	1233.6	10	61.5	.82	28.0	-25.3	3.2	-.8	0	0	-5.0	5.3	-39	40	22	4
3032	1320.0	12	130.9	1.27	22.3	-21.5	1.2	-.8	0	0	-3.4	2.8	-28	29	18	4

SARPA-FR (OT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557   Charge: 5W (370.3 m/s)

Source: FT 155-AL-0   Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	38.6	24	.5	.06	5.1	-4.9	.2	-.3	0	-.5	-.6	.6	-10	10	6	0
2000	81.7	22	1.3	.12	8.6	-8.6	.9	-1.4	1.3	-3.2	-1.8	1.8	-16	16	8	1
3000	128.7	20	2.0	.16	11.0	-11.2	2.4	-2.9	5.0	-7.2	-3.3	3.1	-19	19	10	1
4000	179.4	19	2.7	.20	13.1	-13.2	4.3	-4.6	9.7	-11.5	-4.9	4.8	-20	21	12	1
5000	234.2	17	3.6	.23	15.1	-15.1	6.4	-6.3	14.6	-15.6	-7.0	6.9	-22	22	15	2
6000	294.3	16	4.5	.26	17.2	-17.0	8.5	-7.9	18.9	-19.3	-9.4	9.3	-22	23	18	2
7000	361.8	14	5.7	.29	19.4	-18.9	10.5	-9.5	22.6	-22.4	-12.2	12.3	-22	23	21	2
8000	441.0	11	7.2	.33	21.9	-21.0	12.4	-11.0	25.5	-25.1	-15.5	15.6	-22	23	26	3
9000	542.8	8	9.4	.38	24.6	-23.4	14.1	-12.4	27.6	-27.1	-19.2	19.5	-22	23	31	3
10000	753.1	3	[illegible]	.45	27.1	-26.1	14.3	-13.6	28.0	-28.4	-23.5	22.9	-22	24	37	4
9000	1030.8	8	30.8	.66	26.3	-25.0	13.8	-10.7	24.2	-23.0	-22.6	22.4	-21	22	35	5
8000	1129.5	12	41.2	.79	23.8	-22.5	12.2	-9.1	21.2	-20.3	-19.8	19.7	-19	20	31	6
7000	1205.5	15	54.5	.95	21.1	-19.8	10.6	-6.9	18.5	-17.9	-16.8	16.9	-16	16	27	6
6000	1268.9	17	76.6	1.20	18.1	-17.0	9.0	-5.2	16.2	-15.7	-13.4	13.8	-12	12	22	6
5000	1321.8	21	129.5	1.82	14.9	-13.9	6.5	-5.2	14.3	-14.1	-10.6	10.1	-4	5	19	6
4707	1335.0	22	149.4	1.82	14.2	-13.5	5.8	-5.2	14.1	-14.0	-10.6	9.1	-2	2	19	6

SARPA-FR (OT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557   Charge: 6W (461.8 m/s)

Source: FT 155-AL-0   Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq (4 Sq Std.)		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	52.5	34	1.2	.10	8.1	-7.7	.4	-.4	-.4	.3	-2.2	2.2	-21	21	9	1
4000	120.0	26	2.9	.22	14.4	-13.9	1.7	-1.6	-1.1	.2	-8.2	8.2	-32	33	12	1
6000	205.7	21	4.8	.32	18.3	-18.0	4.7	-4.3	2.9	-5.3	-14.7	14.0	-35	36	15	2
8000	308.7	18	7.0	.40	20.9	-20.6	9.0	-7.9	11.6	-13.1	-20.6	20.0	-34	36	18	3
10000	436.2	14	9.9	.47	23.5	-23.0	13.6	-11.6	19.7	-20.1	-27.8	27.8	-31	33	21	3
12000	632.2	7	15.5	.57	27.0	-26.1	17.5	-15.2	24.5	-25.0	-37.4	38.5	-26	28	26	5
12500	745.6	5	19.8	.62	27.5	-27.0	17.5	-16.1	24.6	-25.8	-40.2	39.3	-24	27	26	5
12000	957.4	7	32.1	.79	27.6	-26.8	17.5	-15.8	23.2	-23.2	-42.0	40.5	-22	23	28	5
10000	1138.5	15	53.1	1.04	23.7	-22.7	16.2	-13.1	18.7	-19.1	-34.7	34.2	-18	22	24	7
8000	1250.4	21	85.9	1.43	19.0	-18.1	13.6	-7.9	15.3	-15.8	-26.4	26.5	-11	14	19	7
6045	1330.0	30	191.7	2.24	13.6	-13.0	9.2	-7.9	13.7	-14.2	-21.0	17.5	7	-5	16	7

SARPA-FR (OT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557 Charge: 6 RA (461.8 m/s)

Source: FT 155-AL-O Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	52.2	34	.9	.10	8.2	-7.7	.4	-.4	-.4	.3	-2.1	2.1	-21	22	9	1
4000	116.0	32	2.4	.15	15.9	-14.9	1.4	-1.3	-1.3	.9	-8.0	8.3	-36	37	14	1
6000	177.1	32	3.8	.14	22.5	-21.6	2.9	-2.9	-3.1	1.6	-16.8	17.3	-52	54	24	2
8000	243.6	27	5.4	.18	25.8	-25.4	5.5	-5.3	-5.3	1.9	-27.4	27.8	-59	61	33	3
10000	324.2	23	7.0	.24	27.6	-27.5	9.3	-8.6	-4.1	-2.6	-38.1	36.3	-61	62	41	4
12000	421.2	19	8.9	.29	28.5	-28.8	14.3	-12.7	3.2	-10.9	-45.4	43.3	-61	63	48	5
14000	539.6	15	11.7	.33	28.6	-29.5	20.1	-17.3	13.4	-20.6	-53.6	50.7	-58	60	54	6
16000	708.2	8	15.0	.35	27.8	-29.6	24.3	-22.1	22.1	-29.6	-62.0	61.4	-53	55	62	8
16700	861.6	3	19.7	.36	26.9	-29.3	24.3	-23.7	23.4	-32.5	-65.9	61.4	-49	52	62	8
16000	1018.2	10	27.1	.39	24.2	-24.7	24.3	-19.9	24.2	-33.9	-65.8	62.2	-47	49	73	11
14000	1155.9	20	38.3	.43	19.7	-20.5	21.1	-15.3	22.1	-30.3	-56.7	54.1	-42	44	67	12
12000	1243.4	26	51.7	.50	16.1	-16.7	16.6	-10.4	19.5	-26.3	-47.3	45.4	-35	37	60	13
10000	1311.8	33	75.3	.65	12.3	-12.7	12.0	-5.4	17.0	-22.8	-37.3	36.3	-24	27	52	13
7996	1365.0	42	140.2	1.05	7.4	-8.0	5.7	-5.4	15.5	-20.7	-32.8	26.1	-4	6	52	13

SARPA-FR (CT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile: M549, Fuze M557 Charge: 7W (560.8 m/s)

Source: FT 155-AL-0 Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Cor. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq (4 Sq Std.)		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
meters	mils	meters	mils	mils											meters	meters
2000	34.9	52	.8	.07	6.8	-6.5	.3	-.3	-.4	.4	-1.9	1.9	-19	20	11	1
4000	78.1	41	2.1	.16	12.5	-12.5	1.1	-1.0	-1.5	[illegible]	-7.3	7.5	-30	31	12	1
6000	132.8	32	3.7	.25	17.1	-16.5	2.6	-2.4	-3.2	2.7	-15.8	16.5	-33	34	15	2
8000	203.1	26	5.6	.35	20.7	-20.1	5.1	-4.5	-3.8	1.3	-26.4	26.0	-30	31	20	3
10000	290.9	21	7.9	.44	23.1	-22.7	9.0	-7.7	1.5	-4.8	-35.2	33.6	-26	28	24	3
12000	398.1	17	10.6	.52	25.0	-24.6	13.7	-11.4	10.5	-12.4	-42.8	41.5	-21	24	28	4
14000	538.3	12	14.4	.60	27.2	-26.6	18.0	-15.4	18.4	-18.8	-51.5	52.3	-14	17	32	5
15000	643.2	7	17.9	.65	28.8	-28.0	20.8	-17.4	19.9	-20.8	-57.2	59.8	-9	12	35	6
15500	742.3	4	21.8	.70	29.3	-28.8	20.8	-18.4	20.2	-21.4	-60.9	59.8	-5	9	35	6
15000	944.9	8	33.8	.88	29.4	-28.8	20.8	-20.1	18.[illegible]	-19.6	-65.8	59.8	-2	6	39	8
14000	1039.9	13	42.7	.99	27.9	-27.2	21.4	-19.1	16.9	-18.1	-61.7	59.8	-2	4	36	8
12000	1159.8	20	61.7	1.24	24.3	-23.5	19.9	-16.6	14.2	-15.4	-52.4	51.6	2	2	31	9
10000	1246.4	26	92.9	1.61	20.1	-19.3	17.8	-12.7	12.2	-13.3	-42.2	42.3	7	-4	26	9
8000	1312.3	32	182.1	2.41	15.0	-15.8	13.9	-12.7	11.5	-12.7	-35.0	31.2	19	-24	23	9
7705	1320.0	38	199.4	2.41	14.3	-15.5	13.2	-12.7	11.5	-12.8	-35.0	29.8	19	-27	23	9

SARPA-FA (OT) 2768 Dec 75

Table A-8 (continued)

Basic Projectile M549, Fuze M557 — Charge: 7 RA (560.8 m/s)

Source: FT 155-AL-0 — Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std 4 Sq		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	35.0	52	.8	.07	6.5	-6.5	.3	-.3	-.4	.4	-1.9	1.9	-19	20	11	1
4000	77.9	44	2.0	.14	12.8	-12.2	1.0	-1.0	-1.6	1.3	-7.4	7.6	-31	32	13	2
6000	122.1	46	3.3	.14	19.0	-18.2	2.1	-2.0	-3.5	3.1	-15.9	16.5	-44	45	28	3
8000	167.5	41	4.7	.17	22.9	-22.2	3.9	-3.6	-6.1	5.4	-26.2	27.4	-51	53	37	4
10000	220.8	34	6.3	.23	25.3	-24.7	6.4	-5.7	-9.0	7.9	-38.5	40.3	-51	53	43	5
12000	286.9	27	8.1	.30	27.1	-26.6	9.7	-8.4	-10.9	7.6	-52.1	52.1	-47	49	49	6
14000	367.0	23	10.2	.37	28.7	-28.2	13.9	-11.7	-8.0	3.1	-64.0	61.6	-44	46	55	8
16000	465.0	19	12.7	.42	30.1	-29.7	18.9	-15.5	-.6	-3.7	-73.9	70.3	-41	44	62	9
18000	586.8	14	16.0	.47	31.4	-31.0	24.9	-19.8	10.2	-11.3	-82.3	89.4	-39	42	69	11
19000	666.0	11	18.3	.49	32.2	-31.7	27.2	-22.0	15.5	-14.6	-86.5	88.1	-38	41	72	12
20100	819.6	4	23.8	.52	33.[illegible]	-32.7	27.2	-24.5	16.1	-16.6	-97.0	91.2	-36	39	78	14
19000	1039.8	14	36.8	.63	32.6	-32.1	27.2	-22.7	9.2	-11.6	-99.8	94.0	-36	40	87	19
18000	1101.3	19	42.7	.67	31.2	-30.6	26.4	-21.0	7.6	-10.0	-95.0	91.4	-36	40	85	20
16000	1188.5	27	55.3	.77	27.9	-27.4	23.0	-17.3	4.9	-7.8	-84.[illegible]	82.4	-33	36	79	21
14000	1254.3	34	73.4	.91	24.1	-23.4	19.5	-12.5	3.6	-6.4	-71.9	71.7	-25	29	71	21
12000	1307.5	42	110.1	1.21	19.4	-18.4	15.4	-11.1	3.3	-5.8	-58.1	59.5	-10	14	67	22
10486	1340.0	52	176.0	1.56	14.4	-17.5	10.5	-11.1	3.3	-6.3	-58.1	48.2	-5	-7	67	21

[illegible]-FR (OT) 2768 Dec 75

Table A-9

M109 howitzer, 155mm, firing M454

Basic Projectile: XM454

Charge: 1 (310.9 m/s)

Source: FT 155-AJ-2

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb				Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc				
meters	mils	meters	mils	mils													meters	meters
1000	53.4	18	1.3	.06	6.6	-5.7	.2	-.1	.2	-.1	-.3	.3	-7	7				0
2000	110.7	17	2.7	.10	12.8	-11.1	.6	-.4	.6	-.3	-1.1	1.1	-14	14				1
3000	173.0	15	4.4	.14	18.5	-16.0	1.2	-.8	1.1	-.5	-2.5	2.5	-19	19				1
4000	242.2	14	6.5	.18	24.0	-20.7	2.1	-1.4	1.5	-.7	-4.4	4.4	-24	24				1
5000	321.3	12	9.0	.22	29.2	-25.3	3.0	-2.2	1.9	-.8	-6.7	6.8	-28	23				2
6000	416.2	9	12.4	.28	34.1	-29.6	4.2	-3.1	2.2	-.9	-9.4	9.4	-31	32			NOT APPLICABLE	2
7000	547.7	6	18.0	.35	38.9	-33.9	5.7	-4.2	2.2	-1.0	-12.7	12.1	-34	35				2
7600	694.1	3	25.6	.43	39.3	-36.4	6.4	-5.1	2.2	-.9	-13.1	15.5	-35	36				2
7000	997.2	6	49.3	.69	38.7	-32.9	7.2	-6.6	1.7	-.7	-16.1	15.7	-31	31				4
6000	1121.5	10	64.5	.91	32.8	-27.9	7.3	-6.5	1.5	-.6	-14.6	14.3	-25	26				4
5000	1214.9	12	79.6	1.19	27.0	-22.5	7.3	-6.3	1.3	-.5	-12.9	12.7	-20	20				4
4400	1248.1	12	86.1	1.34	24.6	-20.9	7.3	-6.5	1.2	-.5	-12.2	12.0	-18	18				4

SARPA-FR (UT) 2768 Dec 75

Table A-9 (continued)

Basic Projectile. XM454 Charge: 2 (374.9 m/s)

Source: FT 155-AI-2 Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	37.6	25	1.0	.08	4.8	-4.4	.4	-.[illegible]	.9	-.9	-.[illegible]	.5	-7	7		0
2000	79.0	[illegible]	2.1	.12	8.[illegible]	-7.7	1.4	-1.1	3.4	-2.9	-1.7	1.7	-11	11		0
3000	124.4	21	3.4	.17	11.[illegible]	-10.4	2.8	-2.2	6.6	-5.3	-3.4	3.4	-14	15		1
4000	174.3	[illegible]	4.9	.22	1[illegible].6	-12.8	4.5	-3.3	10.1	-7.7	-5.6	5.6	-17	17		1
5000	229.5	17	6.7	.26	17.3	-15.0	6.2	-4.4	13.3	-10.0	-8.3	8.3	-18	19		1
6000	291.5	15	8.9	.31	20.0	-17.1	8.1	-6.0	16.3	-12.1	-11.4	11.6	-19	20		1
7000	363.2	13	11.5	.36	22.7	-19.2	10.0	-7.4	18.8	-13.8	-15.0	15.3	-20	21		2
8000	450.3	10	15.1	.41	25.5	-21.4	12.0	-8.8	20.8	-15.2	-19.1	19.6	-20	21		2
9000	570.9	6	20.9	.49	28.6	-23.8	13.9	-10.[illegible]	22.0	-16.1	-23.1	24.7	-21	22	NOT APPLICABLE	4
9600	710.3	3	28.9	.58	29.4	-25.3	13.9	-11.3	22.0	-16.3	-27.0	26.6	-21	22		3
9000	968.8	[illegible]	49.7	.92	29.2	-24.3	13.9	-12.2	19.9	-13.9	-28.7	27.7	-18	19		3
8000	1077.5	11	62.1	1.[illegible]	25.9	-21.4	13.7	-11.7	17.6	-12.3	-26.6	25.8	-15	16		4
7000	1157.9	14	73.5	1.25	22.[illegible]	-18.4	13.0	-11.3	15.4	-10.9	-24.2	23.5	-12	13		4
6000	1226.3	15	85.1	1.55	18.7	-15.3	12.5	-10.9	13.4	-9.4	-21.7	21.1	-9	9		4
5700	1245.3	16	88.8	1.66	17.6	-14.4	12.4	-10.8	12.8	-9.0	-20.9	20.3	-8	9		4

SARPA-FR (OT) 2768 Dec 75

Table A-9 (continued)

Basic Projectile: XM454 Charge: 3 (550.6 m/s)

Source: FT 155-AJ-2 Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	36.8	49	.9	.09	7.0	-6.5	.2	-.2	-.7	.7	-2.1	2.1	-5	5		1
4000	83.3	38	2.0	.18	12.9	-12.9	1.0	-1.0	-2.8	2.4	-8.0	8.3	-6	6		2
6000	143.4	30	3.6	.29	17.3	-16.7	2.7	-2.5	-4.5	2.5	-16.8	16.8	-3	3		3
8000	219.0	24	5.7	.39	20.4	-19.9	5.7	-5.1	-1.9	-1.4	-25.6	25.2	1	0		4
10000	312.0	19	8.6	.47	22.8	-22.3	9.6	-9.3	3.4	-6.5	-34.6	34.1	6	-5		5
12000	429.4	15	12.9	.56	25.2	-24.6	14.2	-11.9	9.2	-11.7	-44.4	44.5	12	-11	NOT APPLICABLE	7
14000	601.7	8	20.8	.67	28.2	-27.1	19.6	-15.8	13.6	-15.6	-55.9	58.7	19	-19		9
14800	759.8	3	30.5	.77	29.0	-28.5	19.6	-17.4	13.7	-16.3	-61.5	61.2	24	-23		10
14000	967.7	10	49.3	.99	29.0	-28.0	19.6	-20.0	12.2	-14.7	-65.6	62.4	25	-24		13
12000	1112.0	18	68.8	1.28	25.1	-24.0	20.4	-19.0	10.5	-12.7	-57.6	56.0	22	-22		14
10000	1211.3	22	88.5	1.62	20.8	-19.9	19.6	-18.1	9.1	-10.9	-48.9	47.8	20	-19		14
9200	1246.0	24	97.2	1.79	19.0	-18.1	19.2	-17.8	8.5	-10.2	-45.4	44.3	19	-18		15

SARPA-PR (UT) 2768 Dec 75

Table A-10

M109 howitzer, 155mm, firing XM718

Basic Projectile: XM718 | Page 1 of 2

Source: Computer Simulations | Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M3A1 1	800	3578		19.3												
"	1155.6	2688		51.9												
M3A1 2	800	4462		19.3												
"	1155.6	3363		49.7												
M3A1 3	800	5927		19.4												
"	1155.6	4483		48.4												
M3A1 4	800	7503		19.4												
"	1155.6	5698		48.1												
M3A1 5	800	9296		20.1												
"	1155.6	7118		49.9												
M4A2 3	800	6172		19.4												
"	1155.6	4671		48.3												
M4A2 4	800	7658		19.4												
"	1155.6	5818		49.1												

SARPA-FR (OT) 2769 Dec 75

Table A-10 (continued)

Basic Projectile: XM7[illegible]8 Page 2 of 2

Source: Computer Simulation Also Currently Used For Shell: ____

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb / Std.		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M4A2 5	800	9480		20.2												
"	1155.6	7267		50.2												
M4A2 6	800	11712		22.2												
"	1155.6	9072		54.9												
M4A2 7	800	14319		24.3												
"	1155.6	11200		60.1												

SARPA-FR (OT) 2769 Dec 75

Table A-11

M109A1 howitzer, 155mm, firing M107

Basic Projectile: M107, Fuze M557 Charge: 1G (211.8 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	114.7	8	2.5	.05	9.9	-8.6	.1	-.1	0	0	-.2	.2	-10	10	12	1
2000	242.1	7	5.6	.09	19.3	-16.9	.4	-.4	0	0	-.9	.9	-19	20	24	2
3000	398.6	5	10.0	.15	28.2	-24.8	1.0	-.9	0	0	-2.1	2.1	-28	28	35	3
4000	673.6	2	20.1	.25	34.2	-32.4	2.0	-1.6	0	0	-3.7	3.8	-35	35	45	5
3000	1139.2	6	76.9	.78	28.0	-25.0	1.3	1.1	0	0	-2.0	2.3	-24	25	35	7
2321	1250.0	8	153.1	1.23	23.5	-22.8	-1.5	1.1	0	0	-.5	0	-18	18	35	7

SARPA-FR (OT) 2758 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 2G (237.7 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Pr. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	[illegible]
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	90.8	11	1.9	.04	8.8	-7.7	.1	-.1	0	0	-.2	.2	-10	10	6	1
2000	189.3	10	4.3	.08	17.1	-15.2	.4	-.4	0	0	-.9	.9	-19	20	10	2
3000	301.8	8	7.2	.13	25.0	-22.3	.9	-.8	0	0	-2.0	2.1	-28	28	16	3
4000	443.1	6	11.3	.18	32.5	-29.1	1.7	-1.4	0	0	-3.6	3.7	-35	36	23	4
5000	722.4	2	22.5	.28	36.8	-33.6	2.7	-2.3	0	0	-5.8	5.7	-41	[illegible]	32	6
4000	1116.0	6	61.8	.64	32.1	-28.7	2.6	-.1	0	0	-4.3	4.5	-31	32	25	8
3000	1242.1	10	131.8	1.45	25.1	-23.3	-.3	1.6	0	0	-.7	1.5	-21	22	14	8
2738	1265.0	11	166.9	1.45	24.0	-23.3	-1.0	1.6	0	-.1	-.7	.3	-18	19	14	8

SARPA-FR (OT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 3G (277.4 m/s)

Source: FT155-AH-1 Also Currently used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	66.5	15	1.3	.03	7.4	-6.7	.1		0	0	-.2	.2	-10	10	4	1
2000	137.5	14	3.0	.07	14.5	-13.1	.4	-.3	0	0	-.9	.9	-19	20	7	2
3000	215.0	12	4.9	.11	21.2	-19.2	.8	-.7	0	0	-2.0	2.1	-28	28	11	3
4000	302.8	11	7.2	.15	27.6	-25.1	1.4	-1.2	0	0	-3.6	3.6	-35	36	16	4
5000	408.0	8	10.2	.19	33.7	-30.7	2.2	-1.9	0	0	-5.5	5.6	-41	43	21	5
6000	554.3	5	15.1	.25	39.6	-36.1	3.4	-2.8	0	0	-8.0	8.1	-47	48	27	7
6500	690.4	3	20.8	.31	40.1	-38.8	3.9	-3.3	0	0	-9.4	9.4	-49	50	31	8
6000	1004.6	5	43.8	.51	39.3	-35.6	4.5	-3.3	0	0	-9.3	9.4	-43	45	30	10
5000	1146.7	9	67.8	.72	33.1	-30.1	3.7	-.7	0	0	-6.9	7.2	-35	37	23	11
4000	1241.8	13	115.7	1.25	27.3	-25.1	1.4	2.2	.1	0	-3.3	4.1	-26	28	15	11
3355	1285.0	17	194.1	1.66	24.7	-23.7	-2.0	2.2	.1	-.1	-1.6	.7	-23	19	15	11

SAMPA-TR (JT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 4G (318.5 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	50.6	19	.8	.03	6.1	-5.0	.7	[illegible]	1.8	-.3	-.3	.3	-9	9	4	1
2000	104.2	18	2.0	.07	11.8	-9.2	2.2	-.5	5.0	-.8	-1.0	1.0	-16	18	6	2
3000	161.9	17	3.2	.10	17.2	-13.2	3.7	-.9	8.0	-1.3	-2.1	2.1	-23	25	9	3
4000	224.7	15	4.6	.13	22.4	-17.2	5.1	-1.4	10.5	-1.6	-3.7	3.7	-29	31	13	3
5000	294.8	13	6.2	.17	27.5	-21.2	6.5	-2.0	12.4	-1.9	-5.6	5.7	-34	37	17	4
6000	375.9	11	8.2	.21	32.4	-25.3	7.8	-2.8	13.8	-2.1	-8.0	8.1	-39	43	22	5
7000	476.9	9	10.9	.25	37.2	-29.4	9.0	-3.7	14.7	-2.2	-10.7	11.0	-43	47	27	7
8000	634.0	4	16.1	.32	41.1	-33.6	9.6	-4.8	14.8	-2.1	-14.0	14.5	-47	51	34	8
8300	760.9	2	21.6	.34	41.1	-34.9	9.6	-5.2	14.6	-2.1	-15.1	15.0	-48	52	34	8
8000	924.1	4	31.5	.48	41.1	-34.7	9.5	-5.6	13.3	-1.8	-15.5	15.4	-46	50	37	11
7000	1078.1	9	47.3	.62	37.3	-30.7	7.9	-4.3	11.1	-1.5	-13.1	13.3	-40	44	32	12
6000	1174.9	12	65.9	.81	32.3	-26.7	6.2	-1.3	9.6	-1.3	-10.2	10.6	-33	36	26	12
5000	1247.8	16	100.4	1.22	27.5	-22.6	3.6	-.3	8.5	-1.2	-6.2	7.2	-24	28	18	12
4104	1295.0	21	171.4	1.70	24.4	-20.4	-1.6	-.3	8.3	-1.4	-3.9	2.6	-19	15	18	12

SARPA-FR (OT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 5G (374.9 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	38.2	24	.9	.08	5.0	-4.8	.2	-.3	0	-.4	-.7	.7	-9	9	5	1
2000	81.8	22	2.0	.14	8.2	-8.1	1.1	-1.5	1.6	-3.3	-2.1	2.0	-14	15	17	2
3000	129.6	20	3.2	.19	10.3	-10.5	2.8	-3.2	5.9	-7.9	-3.7	3.5	-17	17	9	3
4000	181.3	19	4.4	.23	12.0	-12.2	5.0	-5.1	11.3	-12.7	-5.4	5.2	-18	19	10	3
5000	237.2	17	5.8	.26	13.7	-13.7	7.2	-6.9	16.6	-17.3	-7.5	7.3	-19	20	12	4
6000	298.7	15	7.3	.29	15.4	-15.3	9.4	-8.7	21.4	-21.4	-10.0	9.9	-20	20	15	5
7000	368.1	13	9.1	.33	17.3	-16.9	11.6	-10.5	25.5	-25.0	-12.9	12.9	-20	20	18	6
8000	450.1	11	11.4	.37	19.4	-18.7	13.6	-12.1	28.9	-28.1	-16.4	16.5	-19	20	21	7
9000	557.8	8	14.9	.42	21.8	-20.8	15.4	-13.6	31.4	-30.6	-20.2	20.6	-19	20	25	9
9800	717.2	3	21.3	.49	23.7	-22.7	15.5	-14.7	31.9	-32.0	-23.8	23.7	-18	20	27	10
9000	1012.2	8	42.2	.72	23.2	-22.1	15.2	-11.2	28.6	-27.0	-23.4	23.2	-16	18	28	14
8000	1114.2	12	56.4	.87	20.9	-19.8	13.1	-8.6	25.3	-24.1	-20.2	20.3	-14	16	24	15
7000	1189.2	15	74.8	1.09	18.4	-17.2	11.0	-4.5	22.6	-21.7	-16.5	16.3	-9	11	20	15
6000	1248.1	19	107.0	1.49	15.5	-14.3	8.2	-3.9	20.7	-20.1	-11.7	12.9	-2	4	16	15
5042	1290.0	26	174.1	1.89	12.1	-11.4	3.1	-2.9	20.4	-20.4	-9.8	7.3	12	-11	16	15

SARPA-FR (O.) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 — Charge: 3W (292.6 m/s)

Source: FT 155-AM-1 — Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	59.7	16	1.2	.03	7.0	-6.3	.2	-.1	.1	0	-.2	.2	-9	9	11	1
2000	123.2	15	2.6	.07	13.7	-12.4	.5	-.3	.2	0	-.9	.9	-17	18	22	2
3000	192.1	14	4.3	.10	20.1	-18.2	1.0	-.6	.3	0	-2.0	2.1	-24	25	32	3
4000	268.6	12	6.2	.14	26.1	-23.7	1.6	-1.1	.3	0	-3.5	3.6	-31	32	42	4
5000	357.0	10	8.7	.18	31.9	-29.1	2.3	-1.8	.3	0	-5.5	5.6	-36	37		5
6000	467.6	8	12.0	.23	37.4	-34.2	3.3	-2.6	.4	0	-7.9	8.0	-41	42	61	6
7000	646.6	3	16.8	.30	41.7	-39.2	4.6	-2.6	.3	0	-10.8	11.2	-45	46	70	8
7200	734.9	2	23.1	.31	41.7	-40.2	4.6	-3.9	.3	0	-11.5	11.7	-45	46	70	8
7000	912.3	3	34.8	.45	41.7	-38.8	4.6	-4.3	.3	0	-11.9	11.8	-42	44	69	11
6000	1088.3	8	55.4	.62	36.9	-33.6	4.8	-2.9	.2	0	-9.7	9.9	-36	37	60	12
5000	1193.4	11	82.5	.88	31.2	-28.6	3.5	1.1	.2	0	-6.8	7.3	-28	30	51	12
4000	1268.9	16	148.6	1.69	25.9	-24.3	-.1	1.1	.3	-.1	-2.8	3.4	-19	20	47	12
3616	1290.0	18	192.4	1.69	25.0	-23.9	-1.8	1.1	.2	-.2	-2.8	1.3	-19	15	47	12

SARPA-FR (MT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557

Charge: 4W (336.8 m/s)

Source: FT155-AM-1

Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
1000	46.1	21	.9	.05	4.7	-4.4	.6	-.5	1.9	-1.7	-.4	.4	-7	7	8	1
2000	95.8	19	1.9	.09	8.1	-7.1	2.4	-1.4	6.6	-4.8	-1.2	1.2	-11	11	12	2
3000	149.0	18	3.1	.12	11.2	-9.5	4.4	-2.5	11.9	-7.9	-2.4	2.4	-13	14	15	3
4000	206.4	17	4.4	.16	14.3	-11.8	6.5	-3.5	16.8	-10.6	-4.0	4.0	-15	17	19	3
5000	269.5	15	5.8	.19	17.6	-14.1	8.5	-4.6	21.0	-12.9	-6.1	6.1	-17	19	23	4
6000	340.8	13	7.5	.22	21.1	-16.7	10.3	-5.7	24.4	-14.7	-8.5	8.6	-19	21	28	5
7000	425.1	11	9.7	.26	24.6	-19.4	12.0	-6.8	27.1	-16.0	-11.3	11.5	-20	23	33	6
8000	535.1	7	13.0	.31	28.5	-22.4	13.3	-7.9	29.0	-17.0	-14.6	14.9	-22	25	39	8
8900	736.8	3	20.8	.38	31.4	-25.4	13.4	-9.0	29.1	-17.1	-18.0	17.9	-23	27	43	9
8000	1025.2	8	41.3	.60	30.3	-24.6	12.4	-7.6	25.1	-13.4	-17.0	17.1	-21	24	44	12
7000	1131.3	11	56.6	.76	27.0	-21.8	10.1	-5.2	21.8	-11.7	-14.1	14.4	-18	21	38	13
6000	1209.7	15	78.4	1.00	23.4	-18.7	7.8	-.5	19.2	-10.4	-10.7	11.4	-13	16	32	13
5000	1269.8	20	124.7	1.58	19.6	-15.3	4.2	.3	17.5	-9.7	-5.7	7.2	-4	7	25	13
4441	1295.0	24	175.1	1.81	17.6	-13.7	.3	.3	17.4	-9.9	-5.7	3.7	5	-2	25	13

SARPA-FR (OT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 5W (393.2 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	34.7	27	.9	.08	4.9	-4.6	.1	-.2	-.1	0	-.7	.7	-8	8	8	1
2000	74.9	23	2.0	.15	8.7	-8.5	.7	-1.0	.2	-1.4	-2.5	2.4	-13	14	12	2
3000	120.1	21	3.2	.21	11.0	-11.0	2.1	-2.5	3.0	-5.1	-4.4	4.2	-16	16	15	3
4000	169.4	20	4.4	.25	12.7	-12.8	4.1	-4.3	7.8	-9.8	-6.3	6.0	-17	18	18	3
5000	222.7	18	5.7	.28	14.2	-14.2	6.4	-6.1	13.2	-14.5	-8.4	8.1	-17	18	20	4
6000	280.9	16	7.2	.32	15.7	-15.6	8.7	-8.0	18.3	-18.9	-10.9	10.7	-17	18	22	5
7000	345.7	14	8.9	.35	17.2	-17.0	10.9	-9.9	22.8	-22.9	-13.8	13.7	-16	17	25	6
8000	420.4	12	11.0	.39	19.0	-18.6	13.1	-11.6	26.6	-26.3	-17.2	1[illegible].2	-15	16	27	7
9000	512.8	9	13.9	.44	20.9	-20.3	15.2	-13.3	29.6	-29.2	-21.1	21.3	-14	15	30	9
10000	654.4	5	19.2	.51	23.4	-22.2	16.1	-14.8	31.1	-31.5	-25.6	26.5	-12	14	34	10
10300	756.1	3	23.9	.53	23.4	-22.9	16.1	-15.2	31.1	-31.9	-27.1	26.5	-12	13	34	10
10000	922.1	5	34.7	.69	23.8	-23.1	16.1	-13.3	30.8	-29.0	-28.3	27.3	-11	13	36	14
9000	1057.5	10	48.9	.84	22.0	-21.1	15.1	-11.1	26.8	-26.0	-2[illegible].1	24.9	-9	11	33	15
8000	1142.9	14	63.9	1.01	19.8	-18.8	13.2	-8.2	24.0	-23.5	-21.5	21.6	-6	8	29	15
7000	1208.9	17	84.8	1.26	17.2	-16.2	11.1	-4.5	21.7	-21.4	-17.3	17.9	-2	4	25	16
6000	1260.7	22	124.6	1.78	14.2	-13.1	7.9	-4.5	20.4	-20.5	-11.7	1[illegible].3	7	-4	19	16
5 [illegible]	1290.0	29	183.6	2.07	11.5	-10.8	3.4	-4.5	20.4	-21.1	-11.0	8.3	20	-18	19	16

SARPA-FT (OT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 6W (475.5 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	23.5	40	.6	.06	4.2	-3.9	.1	-.1	-.2	.2	-.6	.6	-9	9	8	1
2000	50.4	35	1.5	.12	7.9	-7.5	.4	-.4	-.7	.7	-2.5	2.5	-15	15	10	1
3000	81.6	30	2.5	.18	11.2	-10.7	.5	-.8	-1.6	1.3	-5.5	5.6	-19	19	13	2
4000	117.9	26	3.7	.25	13.9	-13.4	1.7	-1.7	-2.2	.8	-9.3	9.2	-20	21	15	2
5000	159.4	23	5.0	.31	15.8	-15.4	3.2	-3.0	-.8	-1.7	-12.9	12.3	-21	22	18	3
6000	205.4	21	6.4	.36	17.2	-17.0	5.1	-4.9	2.7	-5.5	-16.0	15.1	-21	22	20	3
7000	255.7	19	7.9	.40	18.3	-18.2	7.2	-6.4	7.4	-9.7	18.9	18.0	-20	21	21	4
8000	310.8	17	9.6	.44	19.4	-19.2	9.6	-8.3	12.3	-14.0	-22.0	21.2	-19	20	23	4
9000	371.9	15	11.5	.48	20.5	-20.2	12.0	-10.3	16.8	-17.9	-25.4	24.9	-17	19	24	5
10000	441.8	13	13.8	.52	21.7	-21.3	14.4	-12.2	20.8	-21.5	-29.4	29.2	-15	17	26	6
11000	526.8	10	16.8	.56	23.0	-22.5	16.9	-14.2	23.9	-24.5	-34.0	34.2	-12	14	28	6
12000	650.3	6	21.8	.63	24.6	-23.9	18.5	-16.0	26.1	-27.0	-39.2	40.8	-9	11	31	7
12400	758.4	3	27.3	.66	24.8	-24.6	18.5	-16.8	26.2	-27.8	-41.6	40.8	-7	9	31	7
11000	1049.7	11	53.2	1.00	23.2	-22.5	18.2	[illegible]	22.8	-23.6	-39.9	39.1	-3	5	30	11
10000	1124.5	15	66.6	1.15	21.2	-20.4	16.9	[illegible]	20.9	-21.7	-35.6	35.3	0	3	27	11
8000	1230.4	24	109.7	1.69	16.4	-15.5	13.1	[illegible]	18.4	-19.4	25.0	26.1	10	-8	20	11
6582	1280.0	35	192.8	2.27	11.5	-10.9	6.8	[illegible]	19.4	-20.5	-21.5	16.6	34	-30	18	11

SARPA-FR (OT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile. M107, Fuze M557

Charge: 7W (565.4 m/s)

Source: FT155-AM-1

Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
2000	35.0	51	1.1	.09	6.7	-6.4	.3	-.3	-.7	.6	-2.2	2.3	-15	16	11	1
4000	80.3	38	2.7	.19	12.2	-11.7	1.2	-1.1	-2.6	2.4	-3.7	9.1	-22	23	14	2
6000	141.0	28	5.0	.32	16.5	-16.0	2.9	-2.7	-5.3	3.9	-18.9	19.2	-24	23	19	3
8000	220.7	23	7.9	.43	19.3	-19.0	6.2	-5.4	-3.0	-.5	-28.6	27.2	-20	21	23	4
10000	318.1	19	11.3	.51	21.3	-21.0	10.6	-8.9	5.2	-8.1	-36.2	34.5	-16	18	26	5
12000	437.8	15	15.7	.59	23.1	-22.8	15.6	-12.9	13.8	-15.4	-44.2	43.5	-11	14	30	7
14000	605.8	8	22.7	.69	25.5	-24.9	20.5	-16.9	19.5	-20.8	-54.7	56.3	-4	[illegible]	34	8
14800	760.3	7	30.6	.74	26.4	-26.1	20.5	-18.5	20.2	-22.2	-60.[illegible]	58.4	1	2	36	9
14000	980.7	10	49.2	1.00	26.1	-25.5	20.5	-19.3	18.5	-20.1	-62.3	59.9	4	-1	37	12
12000	1124.9	19	73.6	1.29	22.7	-22.0	20.2	-15.4	15.7	-17.4	-52.6	52.0	9	-6	32	13
10000	1214.0	27	112.1	1.75	18.2	-17.3	17.0	-10.1	14.5	-16.3	-40.2	41.5	20	-17	25	14
8074	1270.0	45	209.2	2.43	11.6	-11.0	9.4	-10.1	15.4	-18.[illegible]	-34.7	27.1	36	-51	25	14

SARPA-FR (OT) 2768 Dec 75

Table A-11 (continued)

Basic Projectile: M107, Fuze M557 Charge: 8(M119)(684.3 m/s)

Source: FT155-AM-1 Also Currently Used for Shell: M110, M116, M121

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	23.6	76	.7	.06	5.6	-5.3	.2	-.2	-.5	.5	-2.0	2.0	-13	13	9	1
4000	53.1	60	1.8	.14	10.2		.9	-.8	-2.1	2.1	-7.9	8.2	-18	19	17	2
6000	91.1	46	3.2	.23	14.1	-13.6	2.1	-1.9	-4.9	4.8	-17.3	18.3	-17	18	25	3
8000	141.4	34	5.2	.34	17.2	-16.8	4.0	-3.6	-8.5	7.8	-30.0	31.6	-11	12	31	4
10000	208.2	27	7.8	.45	19.7	-19.3	7.1	-6.0	-9.9	6.5	-43.8	42.9	-3	5	37	5
12000	291.5	22	11.0	.54	21.6	-21.2	11.1	-9.2	-5.2	.9	-54.7	51.9	3	-1	42	6
14000	392.2	18	14.9	.62	23.3	-22.9	15.8	-12.9	3.2	-6.0	-63.7	61.3	9	-6	47	8
16000	518.6	14	20.1	.70	25.2	-24.7	21.3	-16.9	11.5	-12.1	-73.1	73.6	17	-13	51	9
17000	602.2	10	23.9	.75	26.5	-25.8	24.3	-19.0	14.3	-14.3	-78.8	82.4	22	-18	54	10
18100	781.5	3	33.7	.82	28.1	-27.5	24.3	-21.5	14.8	-15.6	-86.6	85.1	29	-26	58	12
17000	998.2	12	53.1	1.11	28.1	-27.7	24.3	-23.5	10.8	-12.5	-93.3	88.1	34	-30	60	15
16000	1065.1	18	63.3	1.24	26.9	-26.3	25.7	-22.0	9.1	-11.4	-87.8	85.0	36	-32	57	16
14000	1156.2	27	87.4	1.53	23.4	-22.[illegible]	23.8	-16.6	7.5	-10.1	-74.8	74.7	41	-38	49	17
12000	1218.4	40	132.0	2.04	18.6	-17.5	20.0	-11.2	8.0	-10.8	-58.3	61.3	60	-56	44	17
10504	1250.0	56	198.0	2.49	13.1	-16.4	14.1	-11.2	8.8	-13.9	-58.3	48.2	71	-92	44	17

SARPA-FR (OT) 2768 Dec 75

Table A-12

M109A1, XM198 howitzers, 155mm, firing M483A1

Basic Projectile: M483A1

Charge: 1 (XM164), (207.3 m/s)

Source: Computer Simulations

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
154	17.8		0.2													
2293	300		4.8		21	-21										
2872	400		6.6													
3662	600		11.1													
3916	800		17.3		33	-33										
3583	1000		27.7													
2702	1200		55.1													
2424	1244.4		76.0		22	-22										

SARPA-FR (OT) 2768 Dec 75

Table A-12 (continued)

Basic Projectile: M483A1 Charge: 2 (XM164), (253.0 m/s)

Source: Computer Simulation Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq. Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
228	17.8		.3													
3318	300		4.8		26	-26										
4133	400		6.6													
5225	600		11.1													
5553	800		17.4		38	-38										
5093	1000		27.6													
3865	1200		51.1													
3479	1244.4		66.0		24	-24										

SARPA-FR (CT) 2788 Dec 75

Table A-12 (continued)

Basic Projectile: M483A1 Charge: 3 (XM164), (270.1 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
258	17.8		0.3													
3731	300		4.8		25	-25										
4633	400		6.6													
5943	500		11.[illegible]													
6204	800		17.4		39	-39										
5692	1000		27.7													
4327	1200		50.6													
3898	1244.4		64.2		25	-25										

Table A-12 (continued)

Basic Projectile: M483A1 | Charge: 4 (XM164), (354.2 m/s)

Source: Computer Simulations | Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.				Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc			meters	meters
436	17.8		0.3															
5634	300		4.7		18	-18												
6916	400		6.6		(22)	(-22)												
8641	600		11.4		(27)	(-27)												
9189	800		18.0		28	-28												
8474	1000		28.7		(28)	(-28)												
6493	1200		51.6		(22)	(-22)												
5864	1244.4		63.4		19	-19												

SARPA-FR (OT) 2768 Dec 75

Table A-12 (continued)

Basic Projectile: M483A1

Charge: 5 (XM164), (441 m/s)

Source: Computer Simulations

Also Currently Used for Shell:

Basic		Flev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
668	17.8		0.3													
7328	300		5.4		(21)	(-21)										
8834	400		7.5													
10302	600		12.6													
11611	800		19.8		(28)	(-28)										
10783	1000		31.5													
8309	1200		56.5													
7505	1244.4		69.9		(19)	(-19)										

SARPA-FR (UT):768 Dec 75

Table A-12 (continued)

Basic Projectile: M483A1

Charge: 6 (XM201E2), (591.3 m/s)

Source: Computer Simulations

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1174	17.8		0.4													
10462	300		6.6													
12444	400		9.0		25	-25										
14970	600		14.5		28	-28										
15941	800		22.5													
14954	1000		35.7		29	-29										
11603	1200		65.2		23	-23										
10466	1244.4		83.1													

SARPA-FR (OT) 2768 Dec 75

Table A-12 (continued)

Basic Projectile: M483A1

Charge: 7 (XM201E2) (667.5 m/s)

Source: Computer Simulations

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1478	17.8		0.4													
12398	300		7.1		23	-23										
14352	400		9.7													
17110	600		15.4													
18261	800		23.7		31	-31										
17238	1000		37.4													
13432	1200		69.6													
12110	1244.4		90.6		23	-23										

SARPA-FR (OT) 2768 Dec 75

Table A-12 (continued)

Basic Projectile: M483A1

Charge: 8 (XM203E2), (801.6 m/s)

Source: Computer Simulation;

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2085	17.8		0.4													
15537	300		8.0													
17790	400		10.9												(59)	(2)
21041	600		17.5												(70)	(4)
22603	800		25.6												(75)	(7)
21711	1000		39.6												(72)	(18)
17109	1200		80.4												(57)	(14)
15335	1244.4		116.4													

SARPA-FR (OT) 2788 Dec 75

Table A-13

M109A1, XM198 howitzers, 155mm, firing XM708E2

Basic Projectile: XM708E2 Page 1 of 2

Source: Computer Simulations Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
XM164 1	300	2500														
"	800	4200														
"	1244	2620														
XM164 2	300	3600														
"	800	5950														
"	1244	3800														
XM164 3	300	4100														
"	800	6750														
"	1244	4350														
XM164 4	300	6050														
"	800	10050														
"	1244	6450														
XM164 5	300	7950														
"	800	12560														
"	1244	8[illegible]70														

SARPA-FR (CT) 2769 Dec 75

Table A-13 (continued)

Basic Projectile: XM708E2 Page 2 of 2

Source: Computer Simulations Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
XM201E2 6	300	11050														
"	800	16700														
"	1244	11050														
XM201E2 7	300	13000														
"	800	19300														
"	1244	12800														
XM203E2 8	300	16480														
"	800	24150														
"	1244	16150														

SARPA-FR (OT) 2769 Dec 75

Table A-14

M109A1, XM198 howitzers, 155mm, firing XM708E3

Basic Projectile: XM708E3

Page 2 of 2

Source: Computer Simulations

Also Currently Used For Shell: ____

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	H .	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
XM201E2 6	300	11000														
"	800	16650														
"	1244	11200														
XM201E2 7	300	12850														
"	800	19150														
"	1244	13100														
XM203E2 8	300	16400														
"	800	23950														
"	1244	16700														

SARPA-FR (OT) 2769 Dec 75

Table A-14 (continued)

Basic Projectile: XM708E3 Page 1 of 2

Source: Computer Simulations Also Currently Used For Shell: ____

Basic			Elev Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
XM164 1	300	2460														
"	800	4200														
"	1244	2650														
XM164 2	300	[illegible]														
"	800	5300														
"	1244	3700														
XM164 3	300	4050														
"	800	6700														
"	1244	4300														
XM164 4	300	6150														
"	800	9950														
"	1244	6400														
XM164 5	300	7900														
"	800	12640														
"	1244	8100														

SARPA-FR (OT) 2769 Dec 75

Table A-15

M107 self-propelled gun, 175mm, firing M437A1, M437A2

Basic Projectile: M437A2 Charge: 1 (510.5 m/s)

Source: FT175-A-1 Also Currently Used for Shell: M437A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 3 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	41.7	44	.8	.07	7.6	-7.2	.2	-.2	-.5	[illegible]	-1.7	1.7	-14	14	22	[illegible]
4000	92.1	36	1.8	.15	14.2	-13.5	1.0	-.9	-1.9	1.7	-6.6	6.8	-24	24	20	1
6000	154.6	29	3.0	.24	19.8	-19.0	2.3	-2.1	-4.0	3.3	-14.4	14.9	-29	30	19	1
8000	233.0	23	4.2	.33	23.8	23.3	4.8	-4.4	-4.1	.4	-23.4	22.5	-31	32	21	1
10000	328.[illegible]	19	5.6	.41	26.5	-26.1	8.7	-7.6	4.8	-6.6	-30.3	28.8	-32	33	23	2
12000	443.1	16	7.3	.47	28.8	-28.4	13.5	-11.4	12.2	-14.7	-36.8	35.4	-32	33	25	2
14000	599.[illegible]	10	10.0	.53	[illegible]1.6	-30.8	18.5	-15.3	27.6	-21.8	-44.2	43.8	-32	37	27	3
15100	774.1	4	14.7	.59	33.7	-32.[illegible]	18.8	-17.3	22.0	-24.0	-49.4	47.9	-31	33	29	3
14000	1018.2	11	26.9	.76	32.9	-32.0	19.0	6.5	17.9	-19.3	-49.7	48.1	-30	31	29	4
12000	1151.7	19	42.6	.94	28.9	-28.0	17.0	-14.4	14.4	-16.1	-42.4	41.5	-25	28	27	5
11900	1157.0	19	43.6	.95	28.[illegible]	-27.7	16.9	[illegible]	14.3	-15.9	-42.0	41.1	-26	28	27	5

SARPA-FR (OT) 2768 Dec 75

Table A-15 (continued)

Basic Projectile: M437A2 — Charge: 2 (704.1 m/s)

Source: FT175-A-1 — Also Currently Used for Shell: M437A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 3 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2000	21.5	87	.6	.04	5.6	-5.3	.1	-.1	-.4	.4	-1.4	1.4	-7	7	24	1
4000	46.5	74	1.2	.09	10.5	-10.1	.5	-.5	-1.7	1.6	-5.6	5.7	-11	11	25	1
6000	76.1	62	2.0	.14	14.9	-14.4	1.3	-1.2	-3.8	3.5	-12.3	12.8	-12	12	27	2
8000	111.4	52	2.9	.20	18.7	-18.2	2.4	-2.3	-6.5	6.1	-21.5	22.6	-10	11	31	2
10000	154.2	42	4.0	.27	22.2	-21.6	4.0	-3.6	-9.9	9.3	-32.9	35.0	-6	7	36	3
12000	205.6	34	5.3	.35	25.3	-24.7	6.0	-5.4	-13.9	12.7	-46.4	49.3	0	1	42	3
14000	271.5	28	6.8	.42	28.3	-27.6	8.8	-7.7	-17.5	13.2	-61.3	62.1	6	-5	49	4
16000	350.0	23	8.5	.50	30.8	-30.2	12.4	-10.5	-17.1	9.3	-75.2	71.9	11	-10	55	4
18000	445.3	19	10.5	.56	33.0	-32.6	17.1	-14.0	-11.0	2.2	-86.2	79.9	14	-13	61	5
20000	565.7	14	13.1	.63	35.1	-34.5	23.3	-18.0	2.1	-6.4	-94.0	89.0	16	-15	65	6
21000	644.9	11	14.9	.67	36.6	-35.6	26.4	-20.3	10.5	-10.6	-95.5	96.0	19	-17	67	7
22100	801.6	4	19.4	.74	38.4	-37.5	26.4	-22.9	11.1	-14.0	-100.0	97.5	22	-20	69	8
21000	1016.8	14	31.2	.90	40.6	-40.9	26.4	-24.9	-.4	-3.2	-112.4	102.5	23	-21	77	10
20000	1075.9	20	37.3	.95	40.1	-39.9	27.3	-24.0	-3.6	-.9	-107.8	102.7	22	-20	75	11
18100	1135.6	27	52.6	1.10	37.6	-37.0	25.5	-22.2	-6.0	1.3	-97.5	95.4	22	-19	69	11

SARPA-FR (OT) 2768 Dec 75

Table A-15 (continued)

Basic Projectile: M437A2 Charge: 3 (914.4 m/s)

Source: FT175-A-1 Also Currently Used for Shell: M437A1

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 3 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
4000	26.8	132	.8	.05	8.2	-8.0	.4	-.3	-1.5	1.4	-4.7	4.8	-15	15	15	2
8000	61.9	99	1.9	.13	15.0	-14.6	1.5	-1.4	-5.8	5.5	-18.5	19.3	-20	21	18	4
12000	109.5	72	3.5	.21	20.4	-20.0	3.7	-3.4	-12.7	11.9	-40.4	43.0	-16	16	27	6
16000	175.3	52	5.5	.31	25.1	-24.6	7.1	-6.4	-21.6	20.3	-69.3	74.8	-3	5	28	8
20000	265.8	38	8.3	.43	30.0	-29.3	11.9	-10.5	-32.1	29.3	-103.9	111.8	13	-11	35	10
24000	385.3	30	11.9	.54	36.3	-35.2	17.9	-15.5	-42.3	34.1	-142.3	149.2	28	-25	44	12
26000	456.9	26	14.2	.59	40.4	-39.0	21.2	-18.3	-47.8	36.8	-162.5	172.6	34	-32	49	13
28000	538.2	23	17.0	.64	46.0	-43.8	24.6	-21.1	-54.6	43.4	-184.3	204.7	42	-38	55	15
30000	633.5	19	20.8	.68	53.4	-50.1	28.0	-24.0	-62.5	54.4	-208.3	240.4	47	-43	63	17
32000	764.1	11	26.9	.72	66.7	-58.5	30.5	-26.9	-72.1	64.5	-234.0	244.6	48	-44	72	20
32800	871.0	5	32.5	.76	68.1	-63.1	30.5	-28.1	-76.4	54.2	-245.0	244.6	44	-40	72	20
32000	1036.0	15	41.7	.82	67.9	-67.3	30.5	-30.9	-44.8	33.9	-231.8	244.6	24	-20	79	28
30000	1120.6	33	57.4	.90	65.3	-64.5	34.5	-28.4	-51.1	43.7	-214.4	221.8	21	-16	75	31
28700	1156.3	40	75.8	.99	63.2	-61.9	31.9	-26.8	-50.8	44.1	-203.1	215.6	20	-16	73	32

SARPK-FR (CY) 2768 Dec 75

Table A-16

M110 self-propelled howitzer, 8-inch, firing M106

Basic Projectile: M106, Fuze M557 Charge: 1 (249.9 m/s)

Source: FT8-J-4 Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	82.0	12	1.1	.03	8.3	-7.4	.1	-.1	0	0	-.2	.2	-11	11	8	0
2000	169.5	11	2.3	.06	16.3	-14.6	.3	-.3	0	0	-.8	.8	-20	21	10	1
3000	266.6	10	3.8	.10	24.0	-21.5	[illegible]	-.6	0	0	-1.7	1.7	-29	30	12	1
4000	381.0	8	5.8	.14	31.4	-28.1	[illegible]	-1.1	0	0	-3.0	3.0	-37	38	16	2
5000	536.5	5	9.0	.19	38.4	-34.6	2.1	-1.8	0	0	-4.7	4.6	-44	45	21	2
5600	729.1	2	14.6	.26	39.7	-39.3	2.6	-2.3	0	0	-6.0	5.9	-48	48	24	3
5000	1035.4	5	32.3	.41	38.0	-33.7	3.3	-2.9	0	0	-6.1	6.0	-42	43	23	3
4200	1164.1	7	49.3	.53	31.8	-29.2	3.3	-2.8	0	0	-5.3	5.2	-35	36	19	4

SARPA-FR (UT) 2768 Dec 75

Table A-16 (continued)

Basic Projectile: M106, Fuze 557 Charge: 2 (274.3 m/s)

Source: FT8-J-4 Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	67.9	14	1.1	.03	7.6	-6.8	.1	-.1	0	0	-.2	.2	-12	12	8	0
2000	139.7	13	2.3	.06	14.8	-13.3	.3	-.2	0	0	-.7	.7	-23	23	9	0
3000	217.5	12	3.7	.08	21.8	-19.7	.6	-.5	0	0	-1.7	1.7	-33	33	11	1
4000	304.6	11	5.4	.12	28.5	-25.8	1.1	-1.0	0	0	-2.9	2.9	-42	42	14	1
5000	407.9	9	7.5	.15	35.0	-31.7	1.7	-1.5	0	0	-4.5	4.6	-50	51	18	1
6000	547.9	6	10.7	.20	41.2	-37.5	2.[illegible]	-2.2	0	0	-6.5	6.6	-58	59	22	2
6600	707.5	3	15.4	.26	42.4	-40.8	3.2	-2.8	0	0	-8.0	7.9	-61	62	25	2
6000	1021.9	6	31.4	.41	40.8	-36.6	3.9	-3.5	0	0	-8.1	8.1	-54	56	24	3
5000	1161.0	9	46.3	.54	33.9	-30.4	3.9	-3.4	0	0	-7.0	7.0	-45	46	21	3

SARPA-FR (OT) 2768 Dec 75

Table A-16 (continued)

Basic Projectile: M106, Fuze M557 Charge: 3 (304.8 m/s)

Source: FT8-J-4 Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	55.0	18	.8	.03	6.7	-5.7	.5	-.1	1.0	-.1	-.2	.2	-12	13	8	0
2000	112.8	17	1.6	.05	12.9	-10.7	1.5	-.3	3.0	-.4	-.8	.7	-23	24	8	1
3000	174.3	16	2.6	.08	18.9	-15.5	2.7	-.6	5.0	-.6	-1.6	1.6	-33	35	10	1
4000	241.0	14	3.7	.10	24.8	-20.3	3.9	-1.0	6.6	-.7	-2.8	2.9	-43	45	11	2
5000	315.4	13	5.0	.13	30.5	-25.2	4.8	-1.5	7.6	-.8	-4.4	4.4	-52	54	14	2
6000	401.9	10	6.6	.16	36.1	-30.1	5.7	-2.1	8.3	-.9	-6.2	6.3	-60	63	17	2
7000	512.0	8	9.0	.20	41.6	-34.9	6.5	-2.8	8.6	-.9	-8.4	8.6	-68	72	21	3
8000	721.3	3	15.1	.28	44.9	-39.9	6.8	-3.8	8.3	-.8	-11.1	11.2	-76	78	26	4
7000	1055.6	8	35.0	.45	41.3	-35.4	6.1	-4.5	6.3	-.6	-10.9	10.8	-66	69	24	5
6000	1164.8	10	49.8	.57	33.4	-30.3	5.6	-4.3	5.3	-.5	-9.5	9.5	-56	58	21	5

SARPA-FM (OT) 2768 Dec 75

Table A-16 (continued)

Basic Projectile: M106, Fuze M557 Charge: 4 (350.5 m/s)

Source: FT8-J-4 Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	43.0	22	.7	.06	4.9	-4.7	.4	-.5	.9	-1.3	-.5	.5	-10	10	10	0
2000	90.2	20	1.4	11	8.1	-7.9	1.6	-1.7	4.1	-4.7	-1.5	1.4	-16	16	10	1
3000	141.0	19	2.2	.14	10.4	-10.1	3.5	-3.3	9.1	-9.1	-2.7	2.6	-20	20	10	1
4000	195.3	18	3.1	.17	12.5	-12.0	5.8	-5.0	14.9	-13.8	-4.1	3.9	-22	23	11	2
5000	253.6	16	4.1	.19	14.6	-13.7	8.0	-6.6	20.6	-18.1	-5.6	5.6	-25	25	12	2
6000	317.1	15	5.3	.21	17.0	-15.6	10.2	-8.3	25.5	-22.0	-7.7	7.6	-27	28	14	3
7000	389.7	13	6.7	.24	19.6	-17.7	12.1	-9.6	29.5	-25.2	-10.0	10.0	-29	30	17	3
8000	473.7	11	8.6	.27	22.6	-20.1	13.7	-10.9	32.7	-27.8	-12.7	12.7	-31	33	20	4
9000	588.3	7	11.5	.31	26.0	-22.8	14.4	-12.6	34.7	-29.7	-15.7	15.9	-34	36	24	4
9700	761.2	2	17.2	.37	27.9	-25.1	14.4	-12.6	34.7	-30.4	-18.1	17.9	-37	39	26	5
9000	993.1	7	30.2	.50	27.8	-24.8	14.2	-10.1	31.5	-25.2	-18.2	17.8	-36	38	28	6
8000	1103.6	11	41.3	.61	25.1	-22.2	11.9	-9.0	27.5	-22.2	-16.4	16.1	-32	34	25	7
7300	1163.1	13	50.2	.69	22.9	-20.2	10.9	-8.1	25.0	-20.2	-15.1	14.9	-29	31	24	7

SARPA-FR (UT) 2768 Dec 75

Table A-16 (continued)

Basic Projectile: M106, Fuze M557 Charge: 5 (420.6 m/s)

Source: FT8-J-4 Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	30.0	31	.4	.06	4.7	-4.4	.1	-.1	-.2	.1	-.6	.6	-9	9	6	0
2000	64.2	27	.8	.12	8.9	-8.4	.4	-.4	-.6	.3	-2.3	2.3	-16	16	7	1
3000	103.1	24	1.3	.18	12.2	-11.8	1.1	-1.2	-.6	-.8	-4.8	4.7	-20	20	9	1
4000	146.8	22	1.9	.24	14.5	-14.3	2.4	-2.5	1.2	-1.6	-7.4	7.1	-22	23	11	2
5000	194.6	20	2.6	.28	16.2	-16.2	4.2	-4.2	5.0	-7.8	-9.7	9.2	-23	24	12	2
6000	264.4	19	3.3	.31	17.6	-17.6	6.4	-6.1	10.2	-12.6	-11.9	11.2	-24	24	14	3
7000	302.4	17	4.2	.34	18.8	-18.8	8.8	-8.0	16.0	-17.6	-14.1	13.4	-24	24	16	3
8000	363.3	16	5.3	.37	20.0	-19.9	11.2	-10.0	21.7	-22.4	-16.5	16.0	-23	24	17	3
9000	431.5	14	6.6	.39	21.5	-21.2	13.4	-11.9	26.2	-26.4	-19.5	19.2	-22	23	20	4
10000	512.4	11	8.3	.42	23.3	-22.7	15.4	-13.6	29.6	-29.8	-23.0	22.9	-21	22	22	5
11000	621.7	7	11.1	.46	25.4	-24.5	16.8	-15.1	32.0	-32.5	-27.0	27.2	-20	21	26	5
11600	747.9	3	15.2	.52	26.2	-25.8	16.8	-16.0	32.2	-33.7	-29.7	28.8	-19	21	27	6
11000	976.8	8	27.9	.67	26.2	-25.3	16.8	-14.1	30.1	-29.8	-30.7	29.4	-18	20	28	8
10000	1078.4	12	38.0	.78	24.1	-23.1	15.5	-13.0	27.0	-27.0	-28.2	27.2	-16	18	26	8
8900	1159.6	15	50.6	.91	21.5	-20.6	14.2	-11.9	24.0	-24.0	-25.3	24.5	-14	15	24	9

SARPA-FR (DT) 2768 Dec 75

Table A-16 (continued)

Basic Projectile: M106, Fuze M557 Charge: 6 (499.9 M/S)

Source: FT8-L-4 Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)												Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
1000	21.1	45	.5	.04	4.0	-3.7	.1	-.1	-.1	.1	-.5	.5	-8	8	3	0
2000	44.7	40	1.0	.09	7.6	-7.2	.3	-.3	-.6	.5	-2.1	2.1	-13	13	6	0
3000	71.3	35	1.6	.14	10.9	-10.4	.7	-.6	-1.3	1.1	-4.6	4.7	-17	17	8	1
4000	101.6	31	2.3	.20	13.9	-13.3	1.2	-1.2	-2.2	1.9	-8.1	8.3	-19	19	10	1
5000	136.2	27	3.0	.26	16.4	-15.9	2.1	-1.9	-3.1	1.9	-12.2	12.4	-19	19	13	1
6000	175.5	24	3.9	.31	18.4	-18.0	3.3	-3.1	-2.8	.4	-16.5	16.1	-18	19	15	1
7000	219.2	22	5.0	.36	20.0	-19.6	5.0	-4.5	-.6	-2.6	-20.3	19.3	-17	18	16	2
8000	267.3	20	6.1	.40	21.2	-20.9	7.1	-6.2	3.2	-6.6	-23.6	22.2	-16	17	18	2
9000	319.7	18	7.4	.43	22.2	-22.0	9.4	-8.1	8.3	-11.3	-26.6	24.8	-15	16	19	2
10000	376.9	17	8.8	.46	23.1	-22.9	11.9	-10.1	14.1	-16.2	-29.3	27.5	-13	15	20	3
11000	440.2	15	10.5	.49	24.0	-23.8	14.5	-12.2	20.0	-21.0	-32.1	30.7	-12	13	21	3
12000	512.5	13	12.5	.52	25.3	-24.7	16.8	-14.2	24.7	-24.6	-35.3	35.3	-9	10	22	3
13000	604.1	9	15.4	.56	26.9	-26.2	19.2	-16.0	26.7	-27.2	-40.0	40.5	-6	7	24	4
13900	734.7	4	21.0	.63	28.1	-27.7	19.2	-17.5	27.1	-29.0	-45.0	44.1	-2	4	25	4
13000	1002.3	10	34.8	.82	27.6	-26.7	19.3	7.1	24.5	-25.4	-46.5	44.4	-1	2	26	6
12000	1083.7	14	41.8	.92	25.7	-24.8	18.5	-16.3	22.2	-23.3	-43.2	41.6	0	2	24	6
10800	1158.1	18	50.4	1.06	23.2	-22.4	17.5	-15.3	19.9	-21.0	-39.1	37.8	0	2	22	6

SARPA-FR (OT) 2768 Dec 75

Table A-16 (continued)

Basic Projectile: M106, Fuze M557
Charge: 7 (594.4 m/s)
Source: FT8-J-4
Also Currently Used for Shell: M426

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 Sq 4 Sq Std.		Range	Defl.
					Dec	Inc	Head	Tail	Dec	nc	Dec	Inc	Dec	Inc		
Meters	mils	meters	mils	mils											meters	meters
2000	31.3	58	.5	.07	6.4	-6.1	.2	-.2	-.5	.5	-1.9	1.9	-13	13	6	1
4000	69.9	46	1.2	.15	11.9	-11.4	.9	-.9	-2.0	1.9	-7.3	7.6	-19	20	11	1
6000	118.7	36	2.1	.24	16.5	-15.9	2.2	-2.0	-4.5	4.2	-16.1	16.9	-19	20	16	2
8000	182.0	28	3.2	.35	20.2	-19.6	4.3	-3.8	-7.1	5.1	-27.5	27.9	-14	15	19	2
10000	262.3	22	4.3	.44	22.8	-22.4	7.7	-6.6	-5.1	.9	-38.2	36.5	-9	10	22	3
12000	350.1	19	6.9	.52	24.7	-24.4	12.2	-10.1	2.8	-7.0	-46.5	43.3	-5	6	24	3
14000	479.3	15	9.8	.59	26.3	-26.0	17.6	-14.2	14.6	-16.9	-53.1	49.7	0	2	26	4
16000	643.2	9	14.8	.66	28.7	-27.7	22.1	-18.5	24.4	-24.1	-59.8	62.6	6	-4	27	5
16800	794.9	3	21.0	.74	30.0	-29.3	22.1	-20.1	23.1	-24.3	-64.5	63.8	12	-9	28	5
16000	981.1	10	33.0	.89	30.0	-29.5	22.1	-21.2	18.9	-20.2	-70.8	66.2	13	-11	29	7
14000	1119.7	19	49.1	1.09	27.1	-26.4	22.0	-19.8	14.9	-16.8	-62.8	60.4	11	-9	26	8
13200	1159.3	21	56.0	1.17	25.7	-25.0	21.4	-19.3	13.7	-15.6	-59.4	57.3	11	-9	24	8

SARPA-FR (OT) 2760 Dec 75

Table A-17

M110 self-propelled howitzer, 8-inch, firing M424

Basic Projectile: M424 Charge: 1 (254 m/s)

Source: FT8-O-4 Also Currently Used for Shell: M422

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	79.6	12	1.2	0.06	8.1	-7.2	0.1	-0.1	0.0	0.0	-0.3	0.3	-4	4	4	0
2000	166.0	11	2.5	0.11	15.7	-14.1	0.5	-0.4	0.1	0.0	-1.1	1.1	-7	7	6	1
3000	263.3	10	4.0	0.16	22.9	-20.6	1.0	-0.8	0.1	0.0	-2.4	2.4	-10	10	8	2
4000	380.0	8	6.0	0.21	29.7	-26.8	1.8	-1.5	0.1	0.0	-4.2	4.2	-12	12	11	2
5000	543.8	5	9.0	0.29	36.2	-32.7	3.0	-2.4	0.0	0.1	-6.5	6.7	-14	14	13	3
5500	711.9	2	12.8	0.37	36.8	-35.6	3.6	-3.0	-0.1	0.2	-8.1	8.1	-15	15	14	3
5000	1019.0	5	23.8	0.56	35.8	-31.9	4.3	-3.8	-0.2	0.3	-8.2	8.2	-13	14	13	4

SARPA-FS (OT) 2768 Dec 75

Table A-17 (continued)

Basic Projectile: M424 — Charge: 2 (359.7 m/s)

Source: FT8-0-4 — Also Currently Used for Shell: M422

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	40.9	23	0.6	0.07	5.0	-4.8	0.3	-0.4	0.5	-0.9	-0.5	0.5	-2	2	5	0
2000	86.3	21	1.3	0.12	9.6	-8.3	1.2	-1.3	2.6	-3.3	-1.7	1.7	-4	4	7	1
3000	135.9	19	2.0	0.17	11.5	-11.1	2.7	-2.6	6.0	-6.3	-3.3	3.3	-5	5	9	1
4000	190.3	18	2.9	0.21	14.1	-13.5	4.5	-3.9	9.9	-9.4	-5.4	5.3	-5	5	11	2
5000	250.3	16	3.8	0.25	16.7	-15.8	6.4	-5.4	13.5	-12.2	-7.8	7.9	-6	6	13	3
6000	318.1	14	4.9	0.30	19.3	-18.0	8.4	-6.8	16.7	-14.7	-10.8	10.9	-6	6	16	3
7000	397.2	11	6.3	0.34	21.9	-20.3	10.3	-8.3	19.3	-16.7	-14.2	14.4	-5	6	18	4
8000	496.7	9	8.1	0.40	24.8	-22.7	12.3	-9.7	21.3	-18.3	-18.0	16.0	-5	6	24	4
9000	656.7	4	11.5	0.49	27.9	-25.5	13.2	-11.2	21.7	-19.2	-22.5	24.0	-5	5	24	5
9200	729.8	3	13.3	0.53	27.9	-26.1	13.2	-11.4	21.7	-19.2	-23.6	24.0	-5	5	24	5
9000	906.8	4	18.8	0.64	27.9	-26.6	13.2	-11.3	21.0	-16.8	-25.3	24.2	-5	5	24	7
8500	1000.5	7	[illegible]	0.72	27.5	-25.4	13.8	-10.8	18.9	-15.6	-24.0	23.6	-4	5	22	7

SAR-A-FR (OT) 2768 Dec 75

Table A-17 (continued)

Basic Projectile: M424 Charge: 3 (547.1 m/s)

Source: FT8-0-4 Also Currently Used for Shell: M422

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
1000	17.7	54	0.3	0.05	3.6	-3.4	0.1	-0.1	-0.1	0.1	-0.5	0.6	-2	2	11	0
2000	37.4	48	0.6	0.09	7.0	-6.5	0.3	-0.3	-0.5	0.4	-2.1	2.1	-4	4	11	1
3000	59.7	42	0.9	0.14	9.9	-9.3	0.6	-0.6	-1.1	[illegible]	-4.6	4.8	-5	5	12	1
4000	84.9	37	1.3	0.19	12.6	-11.9	1.2	-1.1	-1.8	1.5	-8.1	8.3	-5	6	13	2
5000	113.6	33	1.7	0.24	15.0	-14.2	2.0	-1.8	-2.3	2.0	-12.3	12.7	-5	5	15	2
6000	146.[illegible]	29	2.2	0.30	17.0	-16.3	3.0	-2.7	-3.2	1.9	-17.1	17.5	-5	5	17	3
7000	[illegible]	25	2.8	0.35	18.7	-18.0	4.4	-3.9	-3.0	0.8	-22.1	22.0	-4	4	19	3
8000	225.5	23	3.4	0.41	20.1	-19.5	6.0	-5.3	-1.4	-1.3	-26.8	26.2	-3	4	21	4
9000	272.2	20	4.2	0.45	21.3	-20.8	8.0	-6.9	1.2	-4.1	-31.3	30.4	-2	3	24	5
10000	342.1	18	5.0	0.50	22.4	-21.9	10.2	-8.7	4.5	-7.1	-35.6	34.8	-1	2	26	5
11000	382.5	16	6.0	0.54	23.5	-22.9	12.6	-10.5	8.0	-10.0	-40.1	39.7	0	1	29	6
12000	449.5	14	7.2	0.59	24.7	-24.0	15.1	-12.4	11.2	-12.7	-45.0	45.1	1	-1	32	6
13000	530.8	11	8.8	0.64	26.0	-25.2	18.0	-14.4	13.8	-15.1	-50.5	51.3	3	-2	34	7
14000	644.9	7	11.2	0.71	27.9	-26.5	20.1	-16.5	15.6	-17.0	-56.6	59.2	5	-4	37	8
14500	768.8	3	14.4	0.79	27.9	-27.4	[illegible]	-17.6	15.8	-17.5	-60.1	59.2	6	-5	38	10
14000	948.0	7	20.5	0.93	28.4	-27.7	20.1	-19.7	14.3	-15.6	-64.5	59.2	6	-5	37	11
13500	1006.2	10	23.1	1.00	27.9	-27.0	20.4	-19.3	13.4	-14.8	-62.5	60.3	6	-5	35	12

SARPA-FR (OT) 2768 Dec 75

Table A-18

M110 self-propelled howitzer, 8-inch, firing XM711

Basic Projectile: XM711　　　Page 1 of 1

Source: Computer Simulations　　　Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error	
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	
M1-1	853.3	5438		20.6										3	-3		
"	1155.6	4158		46.5										2	-2		
M1-2	853.3	6363		20.1										4	-4		
"	1155.6	4875		50.4										3	-3		
M1-3	853.3	7592		19.8										6	-6		
"	1155.6	5832		45.3										4	-4		
M1-4	853.3	9309		19.8										9	-9		
"	1155.6	7191		45.5										6	-6		
M1-5	853.3	11300		21.2										15	-15		
"	1155.6	8810		48.0										11	-11		
M2-5	853.3	11869		21.6										17	-17		
"	1155.6	9273		48.7										12	-12		
M2-6	853.3	14199		23.4										25	-25		
"	1155.6	11177		51.6										19	-19		
M2-7	853.3	17261		25.6										37	-37	(57)	(4)
"	1155.6	13719		54.8										30	-30	(41)	(7)

SARPA-FR (OT) 2769 Dec 75

Table A-19

M110 self-propelled howitzer, 8-inch, firing XM650E4

Basic Projectile: XM650E4 Page 1 of 2

Source: Computer Simulations Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M1-1	853.3	5430		23.3										3	-3	17
"	1155.6	4159		51.8										2	-2	17
M1-2	853.3	6353												4	-4	22
"	1155.6	4874												3	-3	22
M1-3	853.3	7379		18.0										6	-6	26
"	1155.6	5823		40.7										4	-4	26
M1-4	853.3	9298		18.0										9	-9	
"	1155.6	7174		41.0										6	-6	
M1-5	853.3	11307		19.3										15	-15	
"	1155.6	8803		43.3										11	-11	
M2-5	853.3	11879		19.7										17	-17	29
"	1155.6	9769		43.8										12	-12	22
M2-6	853.3	14216		21.2										25	-25	
"	1155.6	11180		46.6										19	-19	
M2-7	853.3	17280		23.1										37	-37	29
"	1155.6	13734		45.5										30	-30	23

SARPA-FR (CT) 2769 Dec 75

Table A-19 (continued)

Basic Projectile: XM650E4 Page 2 of 2

Source: Computer Simulations Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range / Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M2-6R	924.4	18053		24.0												52
"	1155.6	15123		41.6												44
M2-7R	924.4	21370		26.2												62
"	1155.6	18005		45.4												52

SARPA-FR (OT, 2769 Dec 75

Table A-20

M110 self-propelled howitzer, 8-inch, firing XM753

Basic Projectile: XM753 Charge: 1 (M1, 244 m/s)

Source, Computer Simulation Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity - meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2252	177.8		2.1													
3647	355.6		6.1													
4735	533.3		10.4													
5299	711.1		16.1													
5351	800.0		19.9													
5313	853.3		22.7										3	-3	26	
5258	838.9		24.7													
5174	924.4		27.0													
5003	977.8		30.8													
4603	1066.7		38.9													
4048	1155.6		50.6										2	-2	26	

SARPA FR (OT) 2768 Dec 75

Table A-20 (continued)

Basic Projectile: XM753 Charge: 2 (M1, 268 m/s)

Source, Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2528	177.8		2.3													
4307	355.6		6.0													
5532	533.3		10.3													
6293	711.1		15.9													
6347	800.0		19.7													
6291	853.3		22.4										4	-4	(29)	
6222	888.9		24.4													
6131	924.4		26.6													
5928	977.8		30.5													
5457	1066.7		38.6													
4803	1155.6		50.2										3	-3	(29)	

SARPA-FR (OT) 2768 Dec 75

Table A-20 (continued)

Basic Projectile: XM753 Charge: 3 (M1, 299 m/s)

Source: Computer Simulations Also Currently Used for Shell: ________

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
3040	177.8		2.3													
5243	355.6		[illegible].9													
6301	533.3		10.1													
758[illegible]	711.1		15.6													
7643	800.0		19.3													
[illegible]577	853.3		22.0										5	-6	32	
7500	884.9		24.0													
7382	924.4		26.2													
7141	977.8		30.1													
6578	1066.7		38.2													
589[illegible]	1155.6		49.8										4	-4	32	

SARPA-FR (OT) 2768 Dec 75

Table A-20 (continued)

Basic Projectile: XM753

Source: Computer Simulations

Charge: 4 (M1, 345 m/s)

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 m/1	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	Meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
3760	177.8		2.6													
[illegible]96	355.6		5.4													
9420	533.3		10.1													
9326	711.1		15.[illegible]													
9448	900.0		19.4													
9400	853.3		22.1													
9300	889.4		24.[illegible]										9	-9	18	
92[illegible]	924.[illegible]		26.3													
88[illegible]	977.8		[illegible]													
8182	1066.7		39.4													
7231	1155.6		50.3													
													6	-6	18	

DARPA-TR (U) 2768 Dec 75

Table A-20 (continued)

Basic Projectile: XM753 Charge: 5 (M1, 415 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
4804	177.8		3.4													
8039	355.6		7.0													
10319	533.3		11.3													
11515	711.1		17.2													
11657	800.0		21.1													
11590	853.3		23.8										15	-15	27	
11481	888.9		25.9													
11320	924.4		29.3													
10981	977.8		32.3													
10169	1066.7		41.0													
9004	1155.6		55.5										12	-12	21	

SARPA-FR (OT) 2763 Dec 75

Table A-20 (continued)

Basic Projectile: XM753 Charge: 5 (M2, 442 m/s)

Source: Computer Simulations Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
5284	177.8		3.6													
8692	355.6		7.4													
11079	533.3		11.7													
12358	711.1		17.9													
12518	800.0		21.7													
12454	853.3		24.6										19	-19	15	
12340	888.9		26.7													
12171	924.4		29.1													
11813	977.8		33.2													
10941	1066.7		42.0													
9702	1155.6		54.8										14	-14	12	

SAPPA-FA (OT) 2768 Dec 75

Table A-20 (continued)

Basic Projectile: XM753 Charge: 6 (M2, 512 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
6627	177.8		4.1													
10455	355.6		8.6													
13099	533.3		13.1													
14564	711.1		19.4													
14774	800.0		23.5													
14712	853.3		26.4										27	-27	22	
14590	888.9		28.6													
14403	924.4		31.1													
14000	977.8		35.4													
12885	1066.7		44.5													
11542	1155.6		56.0										21	-21	17	

SARPF-FR (OT) 2768 Dec 75

Table A-20 (continued)

Basic Projectile: XM753 Charge: 7 (M2, 60: r/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
8443	177.8		4.6													
12702	355.6		9.8													
15772	533.3		14.8													
17460	711.1		21.1													
17744	800.0		25.4													
17707	853.3		28.5										40	-40	25	
17583	888.9		31.3													
17379	924.4		33.4													
16927	977.8		37.9													
15759	1066.7		47.3													
14015	1155.6		61.7										31	-31	20	

SARPA-FR (OT) 2768 Dec 75

Table A-21

M110E2 self-propelled howitzer, 8-inch, firing XM711

Basic Projectile: XM711 — Page 1 of 1

Source: Computer Simulations — Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range / Defl.
--	mils	meters	meters	mil	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters
M1-1	853.3	5316		25.9										3	-3	
"	1155.6	4046		59.0										2	-2	
M1-2	853.3	6303		25.3										4	-4	
"	1155.6	4808		57.9										3	-3	
M1-3	853.3	7591		24.9										6	-6	
"	1155.6	5808		57.0										4	-4	
M1-4	853.3	9394		24.6										9	-9	
"	1155.6	7250		56.8										6	-6	
M1-5	853.3	11559		26.6										15	-15	
"	1155.6	9009		60.1										12	-12	
M2-5	853.3	12117		27.4										19	-19	
"	1155.6	9703		61.5										14	-14	
M2-6	853.3	14668		29.5										27	-27	
"	1155.6	11521		55.4										21	-21	
M2-7	853.3	17661		30.2										40	-40	
"	1155.6	13961		70.2										31	-31	

SARPA-FR (OT) 2769 Dec 75

Table A-22

M110E2 self-propelled howitzer, 8-inch, firing XM650E4

Basic Projectile: XM650E4 Page 1 of 1

Source: Computer Simulations Also Currently Used For Shell: ______

Basic			Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Error	
Charge	Elev.	Range	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
--	mils	meters	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	
M1-1	853.3	5309												3	-3	26	
"	1155.6	4046												2	-2	26	
M1-2	853.3	6290		22.9										4	-4	29	
"	1155.6	4806		51.3										3	-3	29	
M1-3	853.3	7575		22.5										6	-6	32	
"	1155.6	5803		50.8										4	-4	32	
M1-4	853.3	9398		22.6										9	-9	18	
"	1155.6	7234		51.2										6	-6	14	
M1-5	853.3	11576		24.3										15	-15	27	
"	1155.6	9004		55.7										12	-12	21	
M2-5	853.3	12437		25.0										19	-19	15	
"	1155.6	9703		55.7										14	-14	12	
M2-6	853.3	14964		26.8										27	-27	22	
"	1155.6	11541		53.8										21	-21	17	
M2-7	853.3	17964		29.0										40	-40	25	
"	1155.6	14009		62.5										31	-31	20	

SARPA-FR (OT) 2769 Dec 75

Table A-23

M110E2 self-propelled howitzer, 8-inch, firing XM753

Basic Projectile: XM753　　Charge: 1 (M1, 247 m/s)

Source: Computer Simulations　　Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
					Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
Meters	mils	meters	mils	mils												
2347	177.8		1.7													
3682	355.6		4.8													
4942	533.3		8.3													
5418	711.1		12.9													
5484	800.0		15.9										3	-3	17	
5443	853.3		18.1													
5374	888.9		19.7													
5296	924.4		21.5													
5121	977.8		24.7													
4615	1066.7		31.0										2	-2	17	
4165	1155.6		40.2													

SARPA-FR (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: X4753 Charge: 2 (M1, 270 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
2804	177.9		1.8													
4374	355.6		4.8													
5690	533.3		8.2													
6346	711.1		[illegible]													
6413	800.0		15.7													
6370	853.3		17.9										4	-4	(22)	
6288	888.9		19.5													
6201	924.4		21.3													
5990	977.8		24.4													
5522	1066.7		30.9													
4878	1155.6		40.0										3	-3	(22)	

SARPA-FR (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 3 (M1, 299 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
3106	177.8		1.8													
5238	355.6		4.7													
6791	533.3		8.0													
7581	711.1		12.5													
7643	800.0		15.[illegible]													
7593	853.3		17.6										6	-[illegible]	15	
7499	888.9		19.2													
7395	924.4		21.0													
7149	977.8		24.1													
6589	1066.7		30.6													
5827	1155.6		39.8										4	-4	26	

SARPA-FR (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 4 (M1, 341 m/s)

Source: Computer simulations Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
3716	177.8		2.0													
6426	355.6		4.7													
8353	533.3		8.1													
9284	711.1		12.5													
9372	800.0		15.5													
9308	853.3		17.6										9	-9		
9206	888.9		19.2													
9071	924.4		21.0													
8783	977.8		24.1													
8103	1066.7		30.7													
7175	1155.6		40.1										5	-5		

SARPA-FR (OT) 2760 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 5 (M1, 405 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 □		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
4643	177.8		2.6													
7824	355.6		5.5													
10069	533.3		8.9													
11242	711.1		13.6													
11392	800.0		15.7													
11317	853.3		18.9										15	-15		
11210	888.9		20.5													
11053	924.4		22.4													
10722	977.8		25.6													
9923	1066.7		32.5													
8906	1155.6		42.4										11	-11		

SARPA-FR (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 5 (M2, 424 m/s)

Source: Computer Simulations Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
4954	177.8		2.8													
8250	355.6		5.7													
10570	533.3		9.2													
11802	711.1		13.9													
11954	800.0		17.0													
11889	853.3		19.3										17	-17	29	
11781	882.9		21.0													
11618	924.4		22.8													
11275	977.9		26.1													
10438	1066.7		33.1													
9272	1155.6		43.1										12	-12	22	

SARPA-FR (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 6 (M2, 497 m/s)

Source: Computer Simulations Also Currently Used for Shell: ______

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity, 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
6320	177.8		3.2													
10053	355.6		6.7													
12648	533.3		10.3													
14085	711.1		15.2													
14289	800.0		18.5													
14229	853.3		20.8										25	-25		
14112	888.9		22.6													
[illegible]	924.4		24.5													
[illegible]	977.8		27.9													
12566	1066.7		33.2													
[illegible]	1155.6		45.7										19	-19		

SARPA-FA (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 7 (M2, 588 m/s)

Source: Computer Simulations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
8179	177.8		3.6													
12469	355.6		[illegible]													
15343	533.3		11.7												(46)	(2)
17050	711.1		16.7												(51)	(3)
17335	800.0		[illegible]												(52)	(3)
17299	853.3		22.7										37	-37	29	(4)
[illegible]	888.9		[illegible]												(51)	(4)
16991	924.4		26.7												(51)	(4)
16537	977.8		30.0												(50)	(5)
15393	1066.7		37.6												(46)	(6)
13747	1155.6		49.7										30	-30	23	(7)

SARPA-FR (OT) 2768 Dec 75

Table A-23 (continued)

Basic Projectile: XM753

Charge: 6R4 (M2, 497 m/s)

Source: Computer Simulation

Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
7039	[illegible]		3.5													
1203[illegible]	355.6		7.5													
155[illegible]	533.3		11.4													
[illegible]499	711.1		15.6													
13024	800.0		18.3													
18136	853.3		20.3												52	
181[illegible]	888.9		21.8													
18013	924.4		23.4													
17687	9[illegible].8		26.3													
[illegible]	1066.[illegible]		32.3													
15090	1151.6		[illegible]												44	

SARPA-FR (OT) 2759 Dec 75

Table A-23 (continued)

Basic Projectile: XM753 Charge: 7RA (M2, 588 m/s)

Source: Computer Simu ations Also Currently Used for Shell:

Basic		Elev. Corr.	Azimuth Corrections		Range Corrections (meters)										Prob. Errors	
Range	Elev.	1 mil	Drift Corr. to Left	Cross-Wind 1 knot	Muzzle Velocity 1 meter/sec		Range-Wind 1 knot		Air Temperature 1%		Air Density 1%		Proj. Wt. of 1 lb		Range	Defl.
Meters	mils	meters	mils	mils	Dec	Inc	Head	Tail	Dec	Inc	Dec	Inc	Dec	Inc	meters	meters
9208	177.8															
14812	355.6															
18396	533.3															
20698	711.1															
21295	800.0															
21421	853.3														52	
21397	888.9															
21283	924.															
20933	977.8															
19796	1066.7															
17929	1155.6														52	

SARPA-FR (OT) 2768 Dec 75

APPENDIX B

SPIN73 PREDICTED AERODYNAMIC COEFFICIENTS

Table B-1

4.2-inch M329A1 without extension

SPINNER 73
4.2 IN.M329A1 W/O EXT.HE

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.600	1.850	0.000	2.980	.13	1.024	2.500	.700

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.151	65.500	740.000	25.400	20.000	20.000	4.151	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.197	3.112	2.041	4.262	.891	-.768	-.693	91.450	-897.000	2.078	3.178	.152	-6.046	-.032
.600	.197	3.112	2.041	4.282	.881	-.768	-.693	91.450	-897.000	2.078	3.178	.152	-6.046	-.032
.800	.200	3.689	2.061	4.365	.861	-.768	-.541	84.917	-811.667	2.278	3.278	.228	-6.046	-.030
.900	.237	4.225	2.122	4.313	.948	-.864	-.261	61.983	-582.333	2.678	3.328	.300	-9.039	-.025
.950	.287	4.726	2.158	4.305	.985	-1.104	-.003	46.650	-449.000	2.978	3.378	.439	-11.938	-.022
1.000	.483	5.415	2.198	4.277	1.024	-1.008	.096	33.183	-294.333	3.078	3.378	.401	-16.569	-.021
1.050	.618	6.036	2.247	[illegible]	1.441	-.912	.180	19.850	-161.000	3.178	3.378	.353	-16.818	-.021
1.100	.671	6.574	2.278	3.592	1.404	-.864	.214	13.983	-102.333	3.228	3.378	.343	-18.739	-.021
1.200	.614	7.334	2.369	3.753	1.370	-.768	.213	9.023	-60.733	3.258	3.378	.305	-20.652	-.020
1.350	.602	6.712	2.482	4.044	1.351	-.768	.228	8.117	-43.667	3.278	3.378	.305	-22.078	-.020
1.500	.581	6.070	2.624	4.295	1.343	-.768	.236	7.363	-35.133	3.288	3.378	.305	-23.411	-.020
1.750	.548	5.444	2.750	4.463	1.359	-.768	.244	6.410	-26.600	3.298	3.378	.305	-23.411	-.020
2.000	.509	4.816	2.896	4.593	1.364	-.768	.252	5.557	-18.067	3.308	3.378	.305	-23.411	-.019
2.500	.433	3.959	3.041	4.883	1.374	-.768	.259	4.703	-9.533	3.318	3.378	.305	-23.411	-.018
3.000	.344	3.275	3.051	5.103	1.308	-.768	.267	3.850	-1.000	3.328	3.378	.305	-23.411	-.017
4.000	.310	2.710	2.951	5.023	1.278	-.768	.267	3.850	-1.000	3.328	3.378	.305	-23.411	-.017
5.000	.248	2.141	2.451	4.934	1.248	-.768	.267	3.850	-1.000	3.322	3.378	.305	-23.411	-.017

Table B-2

4.2-inch M329A1 with extension

SPINNER 73

4.2 IN.M329A1-W EXT(FE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.710	1.990	0.000	2.978	.131	1.014	4.200	1.600

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.191	64.200	847.900	25.230	20.100	20.020	4.151	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CMQ	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMG	CLP
.010	.183	2.869	2.099	3.795	1.170	-.754	-.690	91.690	-879.400	2.063	3.163	.139	-4.845	-.031
.600	.183	2.869	2.099	3.816	1.150	-.754	-.690	91.690	-879.400	2.063	3.163	.139	-4.845	-.031
.800	.186	3.402	2.119	3.895	1.140	-.754	-.535	83.317	-795.667	2.263	3.263	.215	-4.845	-.030
.900	.210	3.945	2.172	4.016	1.125	-.848	-.267	60.613	-570.633	2.663	3.313	.284	-7.834	-.025
.950	.246	4.424	2.203	4.058	1.118	-1.083	-.016	47.730	-439.800	2.963	3.363	.317	-11.731	-.022
1.000	.391	5.007	2.239	4.167	1.115	-.949	.084	32.353	-288.033	3.063	3.363	.381	-15.379	-.021
1.050	.465	5.568	2.293	3.856	1.247	-.855	.166	19.470	-157.200	3.163	3.363	.345	-15.606	-.020
1.100	.466	6.157	2.319	3.942	1.278	-.848	.195	13.713	-99.633	3.213	3.363	.326	-17.473	-.020
1.200	.464	6.762	2.391	4.053	1.293	-.754	.200	9.431	-58.813	3.243	3.363	.290	-19.333	-.020
1.350	.450	6.154	2.499	4.144	1.319	-.754	.215	7.557	-42.067	3.263	3.363	.290	-20.754	-.020
1.500	.432	5.527	2.626	4.228	1.366	-.754	.222	7.119	-33.691	3.273	3.363	.290	-22.078	-.020
1.750	.405	4.914	2.739	4.198	1.445	-.754	.230	6.282	-25.320	3.283	3.363	.290	-22.078	-.019
2.000	.378	4.257	2.856	4.160	1.521	-.754	.237	5.445	-16.947	3.293	3.363	.290	-22.078	-.019
2.500	.327	3.555	2.989	4.093	1.608	-.754	.245	4.607	-8.573	3.303	3.363	.290	-22.078	-.018
3.000	.277	2.937	2.972	3.995	1.633	-.754	.252	3.770	-.200	3.313	3.363	.290	-22.078	-.017
4.000	.235	2.442	2.872	3.951	1.603	-.754	.252	3.770	-.200	3.313	3.363	.290	-22.078	-.017
5.000	.213	[illegible]	[illegible]	3.856	1.573	-.754	.252	3.770	-.200	3.313	3.363	.290	-22.078	-.016

Table B-3

4.2-inch M328A1 without extension

SPINNER 73
4.2 IN M328A1 W/O EXT.NE

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BASE DIAMETER	NOSE RADIUS	BODY LENGTH
4.850	1.850	0.000	2.980	.131	1.014	2.300	.700

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**
4.191	67.000	800.000	27.800	20.000	20.000	4.191	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.197	3.112	2.041	4.262	.591	-.768	-.693	93.450	-897.000	2.078	3.178	.152	-6.046	-.032
.600	.197	3.112	2.041	4.233	.881	-.768	-.693	93.450	-897.000	2.078	3.178	.152	-6.046	-.032
.800	.200	3.669	2.061	4.346	.361	-.768	-.540	84.917	-811.667	2.278	3.278	.228	-6.046	-.030
.900	.237	4.225	2.122	4.313	.948	-.864	-.761	61.583	-592.323	2.678	3.328	.280	-9.039	-.025
.950	.287	4.786	2.158	4.305	.995	-1.104	-.003	48.650	-449.000	2.978	3.378	.337	-11.938	-.022
1.000	.482	5.415	2.198	4.277	1.034	-1.008	.098	33.183	-294.333	3.078	3.378	.401	-16.569	-.021
1.050	.618	6.036	2.247	3.458	1.441	-.912	.186	19.850	-161.000	3.178	3.378	.263	-16.818	-.021
1.100	.621	6.674	2.278	3.596	1.404	-.854	.214	13.983	-102.333	3.228	3.378	.343	-18.735	-.021
1.200	.614	7.334	2.360	3.798	1.370	-.768	.213	9.823	-60.733	3.258	3.378	.305	-20.652	-.020
1.350	.602	6.712	2.482	4.044	1.351	-.768	.228	8.117	-43.667	3.278	3.378	.305	-22.078	-.020
1.500	.581	6.070	2.624	4.295	1.343	-.768	.234	7.263	-35.133	3.288	3.378	.305	-23.411	-.020
1.750	.548	5.444	2.750	4.460	1.358	-.768	.244	6.410	-26.600	3.298	3.378	.305	-23.411	-.020
2.000	.505	4.814	2.850	4.558	1.384	-.768	.252	5.557	-18.067	3.302	3.378	.305	-23.411	-.019
2.500	.433	3.955	3.051	4.883	1.374	-.768	.255	4.703	-9.533	3.318	3.378	.305	-23.411	-.018
3.000	.348	3.275	3.071	5.102	1.308	-.768	.267	3.850	-1.000	3.328	3.378	.305	-23.411	-.017
4.000	.310	2.710	2.951	5.023	1.278	-.768	.267	3.850	-1.000	3.328	3.378	.305	-23.411	-.017
5.000	.288	2.141	2.851	4.928	1.248	-.768	.267	3.850	-1.000	3.328	3.378	.305	-23.411	-.017

Table B-4

4.2-inch M328A1 with extension

SPINNER 73
4.2 IN,M328A1-W EXT(WP)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	REFERENT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.710	1.550	0.000	2.940	.131	1.014	4.200	1.600

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	DES TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.151	66.000	912.000	27.480	20.000	20.000	4.151	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
~~.010~~	~~.183~~	~~2.865~~	~~2.099~~	3.800	1.170	-.750	-.691	91.690	-879.400	2.063	3.163	.138	-4.815	-.021
.600	.183	2.865	2.099	3.821	1.160	-.754	-.691	91.690	-879.400	2.063	3.163	.138	-4.815	-.021
~~.800~~	~~.186~~	~~3.403~~	~~2.119~~	3.855	1.140	-.754	-.543	83.317	-795.667	2.263	3.263	.213	-4.815	-.020
.900	.210	3.905	2.172	4.021	1.129	-.848	-.269	60.813	-570.633	2.663	3.313	.282	-7.805	-.025
~~.950~~	~~.266~~	~~4.424~~	~~2.203~~	~~4.102~~	~~1.118~~	~~-1.083~~	~~-.018~~	~~47.730~~	~~-439.800~~	~~2.563~~	~~3.363~~	~~.415~~	~~-10.702~~	~~-.022~~
1.000	.391	5.007	2.239	4.167	1.119	-.949	.082	32.553	-288.033	3.063	3.363	.379	-15.330	-.021
~~1.050~~	~~.465~~	~~5.566~~	~~2.293~~	3.860	1.257	-.855	.164	19.470	-157.200	3.163	3.363	.343	-15.578	-.020
1.100	.466	6.157	2.319	3.946	1.278	-.548	.198	13.713	-99.433	3.213	3.363	.325	-17.446	-.020
~~1.200~~	~~.464~~	~~6.762~~	2.391	4.056	1.283	-.754	.198	9.031	-58.813	3.243	3.363	.289	-19.307	-.020
1.350	.450	6.154	2.499	4.145	1.319	-.754	.213	7.957	-42.067	3.263	3.363	.289	-20.733	-.020
~~1.500~~	~~.432~~	~~5.527~~	~~2.626~~	~~4.231~~	~~1.368~~	~~-.754~~	~~.221~~	~~7.119~~	~~-33.653~~	~~3.273~~	~~3.363~~	~~.289~~	~~-22.066~~	~~-.020~~
1.750	.405	4.914	2.739	4.203	1.449	-.754	.228	6.282	-25.320	3.283	3.363	.289	-22.066	-.019
~~2.000~~	~~.378~~	~~4.257~~	~~2.856~~	4.365	1.521	-.754	.236	5.445	-16.947	3.293	3.363	.289	-22.066	-.015
2.500	.327	3.555	2.989	4.075	1.608	-.754	.243	4.607	-8.573	3.303	3.363	.289	-22.066	-.018
~~3.000~~	~~.273~~	~~2.957~~	~~2.972~~	~~4.069~~	~~1.633~~	~~-.754~~	.251	3.770	-.200	3.313	3.363	.289	-22.066	-.017
4.000	.239	2.442	2.872	3.956	1.603	-.754	.251	3.770	-.200	3.313	3.363	.289	-22.066	-.017
~~5.000~~	~~.217~~	~~[illegible]~~	~~2.772~~	~~3.902~~	~~1.573~~	~~-.754~~	~~.251~~	~~3.770~~	~~-.200~~	~~3.313~~	~~3.363~~	~~.289~~	~~-22.066~~	~~-.016~~

Table B-5

4.2-inch M335A1 without extension

SPINNER 73
4.2 IN.M335A1 W/O EXT.IL

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.800	1.850	0.000	2.910	.131	1.014	2.500	.700

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.191	62.600	800.000	26.470	20.000	20.000	4.191	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.197	3.112	2.041	4.115	.891	-.768	-.635	93.450	-897.000	2.078	3.178	.205	-7.130	-.032
.600	.197	3.112	2.041	4.140	.881	-.768	-.635	93.450	-897.000	2.078	3.178	.205	-7.130	-.032
.800	.200	3.685	2.061	4.221	.861	-.768	-.486	84.917	-811.667	2.278	3.278	.282	-7.130	-.030
.900	.237	4.225	2.122	4.164	.948	-.864	-.201	61.983	-582.333	2.678	3.328	.361	-10.087	-.025
.950	.287	4.786	2.158	4.154	.985	-1.104	.075	48.650	-449.000	2.978	3.378	.516	-14.979	-.022
1.000	.483	5.415	2.198	4.124	1.035	-1.408	.165	33.183	-294.333	3.078	3.378	.471	-17.602	-.021
1.050	.618	6.076	2.247	3.300	1.441	-.912	.244	19.850	-161.000	3.178	3.378	.426	-17.841	-.021
1.100	.621	6.674	2.278	3.431	1.404	-.864	.274	13.983	-102.333	3.228	3.378	.404	-19.752	-.021
1.200	.614	7.334	2.360	3.633	1.370	-.768	.267	9.823	-50.733	3.258	3.378	.359	-21.632	-.020
1.350	.602	6.712	2.483	3.871	1.351	-.768	.282	8.117	-43.667	3.278	3.378	.359	-22.879	-.020
1.500	.581	6.070	2.624	4.112	1.343	-.768	.292	7.263	-35.133	3.288	3.378	.359	-23.888	-.020
1.750	.548	5.444	2.750	4.268	1.358	-.768	.298	6.410	-26.600	3.298	3.378	.359	-23.888	-.020
2.000	.509	4.814	2.886	4.396	1.384	-.768	.305	5.557	-18.067	3.308	3.378	.359	-23.888	-.019
2.500	.433	3.955	3.041	4.670	1.374	-.768	.313	4.703	-9.533	3.318	3.378	.359	-23.888	-.018
3.000	.348	3.275	3.051	4.888	1.308	-.768	.321	3.850	-1.000	3.328	3.378	.359	-23.888	-.017
4.000	.310	2.710	2.951	4.816	1.278	-.768	.321	3.850	-1.000	3.328	3.378	.359	-23.888	-.017
5.000	.289	2.141	2.851	4.735	1.248	-.768	.321	3.850	-1.000	3.328	3.378	.359	-23.888	-.017

Table B-6

4.2-inch M335A1 with extension

SPINNER 73

4.2 IN.M335A1-W EXT(LIM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FR NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.716	1.550	0.600	2.910	.131	1.014	4.200	1.600

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.191	63.100	807.000	21.700	20.000	20.000	4.191	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.195	2.864	2.055	3.653	1.170	-.754	-.638	91.690	-879.400	2.063	3.163	.191	-5.857	-.031
.610	.193	2.855	2.059	3.674	1.160	-.754	-.638	91.690	-879.400	2.063	3.163	.191	-5.857	[illegible]
.800	.116	3.493	2.119	3.751	1.140	-.754	-.488	83.317	-795.667	2.263	3.263	.266	-5.857	[illegible]
.900	.210	3.909	2.172	3.868	1.129	-.848	-.209	60.813	-570.633	2.663	3.313	.342	-8.812	-.025
.940	.264	[illegible]	2.203	3.946	1.118	-1.083	.057	47.730	-439.800	2.562	3.363	.491	-11.701	-.022
1.000	.291	5.007	2.239	4.010	1.119	-.969	.151	32.553	-298.033	3.063	3.363	.448	-16.323	-.021
1.050	.465	5.565	2.293	3.700	1.297	-.855	.226	19.470	-157.200	3.163	3.363	.405	-16.559	-.023
1.100	.466	6.157	2.319	3.764	1.278	-.848	.257	13.713	-99.633	3.213	3.363	.384	-18.418	-.020
1.200	.454	6.762	2.391	3.851	1.283	-.754	.251	9.631	-58.813	3.243	3.363	.341	-20.246	-.020
1.250	.450	6.154	2.459	3.974	1.319	-.754	.266	7.557	-42.067	3.263	3.363	.341	-21.494	-.020
1.500	.432	5.527	2.626	4.050	1.368	-.754	[illegible]	7.119	-33.653	3.273	3.363	.341	-22.502	-.020
1.750	.405	4.914	2.739	4.011	1.445	-.754	.281	6.282	-25.320	3.283	3.363	.341	-22.502	-.019
2.000	.374	4.251	2.856	3.565	1.521	-.754	.285	5.445	-16.947	3.292	3.363	.341	-22.502	-.019
2.500	.327	3.555	2.969	3.890	1.608	-.754	.296	4.607	-8.573	3.303	3.363	.341	-22.502	-.018
3.000	.272	2.957	2.972	3.797	1.633	-.754	.304	3.770	-.200	3.313	3.363	.341	-22.502	-.017
4.000	.239	2.442	2.872	3.755	1.603	-.754	.304	3.770	-.201	3.313	3.363	.341	-22.502	-.017
5.000	.217	1.924	2.773	3.708	1.573	-.754	.304	3.770	-.200	3.313	3.363	.34	-22.502	-.016

Table B-7

4.2-inch M329A2 (M329A1E1)

SPINNER 73

M329A1E1(HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	ECCM LENGTH
4.102	2.354	.665	2.517	.131	1.014	5.800	.895

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.151	45.000	414.000	20.620	20.000	20.000	4.151	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMG	CLP
.010	.094	2.254	1.393	3.394	.087	-.743	-.223	75.800	-760.502	2.204	3.176	.485	-10.107	-.027
.600	.094	2.254	1.392	3.404	.072	-.743	-.233	75.800	-760.502	2.204	3.176	.485	-10.107	-.027
.800	.097	2.756	1.413	3.665	-.076	-.743	-.101	72.508	-687.578	2.380	3.264	.555	-10.107	-.026
.900	.140	3.368	1.477	4.012	-.199	-.825	.114	52.909	-491.593	2.655	3.237	.594	-11.547	-.022
.950	.192	3.717	1.770	3.554	.486	-1.030	.280	41.515	-377.649	2.788	3.155	.657	-13.479	-.019
1.000	.346	4.059	2.039	3.343	.877	-.948	.388	28.297	-245.473	2.926	3.199	.646	-15.702	-.018
1.050	.423	4.542	2.167	2.874	1.191	-.866	.460	16.903	-131.529	3.072	3.252	.636	-15.511	-.018
1.100	.418	5.057	2.263	2.813	1.274	-.825	.520	11.889	-81.393	3.148	3.282	.631	-16.002	-.018
1.200	.401	5.526	2.373	2.747	1.275	-.743	.542	8.334	-45.843	3.246	3.352	.620	-16.208	-.017
1.350	.385	5.009	2.478	2.929	1.335	-.743	.555	6.876	-21.258	3.264	3.352	.620	-13.819	-.017
1.500	.365	4.476	2.604	2.854	1.405	-.743	.561	6.147	-23.965	3.273	3.352	.620	-9.711	-.017
1.750	.343	3.956	2.705	2.781	1.489	-.743	.568	5.417	-16.673	3.282	3.352	.620	-9.711	-.017
2.000	.318	3.502	2.745	2.773	1.507	-.743	.575	4.688	-9.380	3.290	3.352	.620	-9.711	-.016
2.500	.286	2.710	2.924	3.049	1.475	-.743	.561	3.959	-2.088	3.299	3.352	.620	-9.711	-.016
3.000	.256	2.213	2.858	2.928	1.507	-.743	.588	3.230	5.204	3.308	3.352	.620	-9.711	-.015
4.000	.223	1.785	2.798	2.932	1.469	-.743	.588	3.230	5.204	3.308	3.352	.620	-9.711	-.015
5.000	.203	1.364	2.658	2.930	1.431	-.743	.588	3.230	5.204	3.308	3.352	.620	-9.711	-.014

Table B-8

105mm M1 (HE)

SPINNER 73

105MM.M1(HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.715	2.560	.427	3.010	.133	1.015	6.174	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.126	79.400	762.000	33.000	18.000	18.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.127	2.576	1.675	4.120	.515	-.803	-.461	91.788	-980.378	2.436	3.465	.369	-7.120	-.041
.600	.127	2.578	1.675	4.202	.501	-.803	-.461	91.788	-880.378	2.436	3.465	.369	-7.120	-.041
.800	.136	3.126	1.695	4.417	.404	-.803	-.310	83.406	-796.556	2.624	3.563	.444	-7.120	-.030
.900	.144	3.702	1.736	4.727	.287	-.857	-.052	60.878	-571.283	2.552	3.566	.495	-9.406	-.025
.950	.154	4.126	[illegible]	4.358	.747	-1.133	.163	47.781	-440.311	3.154	3.537	.597	-11.812	-.022
1.000	.341	4.626	2.050	4.050	1.034	-1.039	.276	32.586	-288.383	3.276	3.564	.575	-15.697	-.021
1.050	.432	5.206	2.094	3.344	1.413	-.445	.374	19.491	-157.411	3.406	3.595	.553	-15.200	-.020
1.100	.433	5.683	2.243	3.767	1.330	-.857	.414	13.728	-99.783	3.472	3.614	.542	-16.509	-.020
1.200	.425	6.241	2.317	3.866	1.344	-.843	.429	9.642	-58.970	3.544	3.657	.520	-17.792	-.020
1.350	.414	5.675	2.427	3.921	1.355	-.803	.444	7.966	-42.156	3.563	3.657	.520	17.608	-.020
1.500	.396	5.062	2.558	3.977	1.455	-.803	.452	7.127	-33.773	3.572	3.657	.520	-17.393	-.020
1.750	.375	4.522	2.671	3.955	1.528	-.803	.459	6.289	-25.391	3.582	3.657	.520	-17.393	-.019
2.000	.352	3.963	2.786	3.900	1.612	-.803	.467	5.451	-17.009	3.591	3.657	.520	-17.393	-.019
2.500	.310	3.204	2.912	3.840	1.691	-.803	.474	4.613	-8.627	3.601	3.657	.520	-17.393	-.018
3.000	.265	2.644	2.857	3.734	1.721	-.803	.482	3.774	-.244	3.610	3.657	.520	-17.393	-.017
4.000	.231	2.169	2.797	3.651	1.691	-.803	.482	3.774	-.244	3.610	3.657	.520	-17.393	-.017
5.000	.205	1.451	2.667	3.442	1.640	-.803	.482	3.774	-.244	3.610	3.657	.520	-17.393	-.016

Table B-9

105mm M60 (WP)

SPINNER 73

105MM M60(WP)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.715	2.580	.487	3.010	.133	1.015	6.174	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.130	82.380	925.000	34.800	18.000	18.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNFA	CNFA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.127	2.576	1.675	4.180	.515	-.803	-.461	91.788	-880.378	2.436	3.469	.369	-7.120	-.031
.600	.127	2.576	1.675	4.203	.501	-.803	-.461	91.788	-880.378	2.436	3.469	.369	-7.120	-.031
.800	.136	3.126	1.695	4.417	.404	-.803	-.310	83.406	-796.556	2.624	3.563	.444	-7.120	-.030
.900	.144	3.703	1.736	4.727	.287	-.857	-.052	60.878	-571.283	2.952	3.566	.499	-9.406	-.025
.950	.154	4.126	1.926	4.358	.747	-1.133	.153	47.781	-440.311	3.154	3.537	.597	-11.810	-.022
1.000	.341	4.628	2.050	4.050	1.034	-1.039	.276	32.588	-288.383	3.278	3.564	.575	-15.697	-.021
1.050	.433	5.208	2.054	3.344	1.413	-.945	.374	19.491	-157.411	3.406	3.595	.553	-15.200	-.020
1.100	.433	5.603	2.243	3.767	1.330	-.857	.414	13.728	-99.783	3.472	3.614	.542	-16.509	-.020
1.200	.425	6.241	2.317	3.860	1.344	-.803	.425	9.642	-58.920	3.544	3.657	.520	-17.792	-.020
1.350	.414	5.675	2.427	3.921	1.395	-.803	.444	7.966	-42.156	3.563	3.657	.520	-17.608	-.020
1.500	.395	5.467	2.558	3.977	1.455	-.803	.452	7.127	-33.773	3.572	3.657	.520	-17.393	-.020
1.750	.375	4.532	2.671	3.959	1.528	-.803	.459	6.289	-25.391	3.582	3.657	.520	-17.393	-.019
2.000	.352	3.963	2.725	3.900	1.612	-.803	.467	5.451	-17.009	3.591	3.657	.520	-17.393	-.019
2.500	.310	3.204	2.912	3.840	1.691	-.803	.474	4.613	-8.627	3.601	3.657	.520	-17.393	-.018
3.000	.265	2.644	2.892	3.734	1.721	-.803	.482	3.774	-.244	3.610	3.657	.520	-17.393	-.017
4.000	.231	2.169	2.797	3.691	1.691	-.803	.482	3.774	-.244	3.610	3.657	.520	-17.393	-.017
5.000	.205	1.655	2.697	3.642	1.660	-.803	.482	3.774	-.244	3.610	3.657	.520	-17.393	-.016

Table B-10

105mm M60 (gas or smoke)

SPINNER 71
105MM M60(GAS OR SMOKE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.715	2.560	.447	3.050	.132	1.015	6.174	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.130	78.100	782.000	33.000	18.000	18.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.127	2.576	1.675	4.247	.515	-.803	-.493	91.788	-880.378	2.436	3.469	.337	-6.453	-.031
.600	.127	2.576	1.675	4.265	.561	-.863	-.493	91.788	-880.378	2.436	3.469	.337	-6.453	-.031
.800	.130	3.124	1.695	4.415	.404	-.843	-.342	83.405	-796.556	2.624	3.563	.412	-6.452	-.030
.900	.144	3.702	1.734	4.756	.287	-.857	-.088	61.878	-571.263	2.952	3.566	.463	-8.760	-.025
.950	.194	4.126	1.926	4.436	.747	-1.133	.116	42.781	-440.311	3.154	3.537	.552	-11.168	-.022
1.000	.341	4.628	2.050	4.132	1.034	-1.029	.236	37.588	-288.383	3.278	3.564	.533	-15.060	-.021
1.050	.433	5.206	2.054	3.427	1.413	-.545	.336	19.491	-157.411	3.406	3.555	.515	-14.569	-.020
1.100	.433	5.683	2.243	3.857	1.330	-.857	.373	13.729	-99.783	3.472	3.614	.506	-15.881	-.020
1.200	.425	6.241	2.317	3.953	1.344	-.863	.397	4.642	-58.926	3.544	3.657	.487	-17.181	-.020
1.350	.414	5.675	2.427	4.018	1.395	-.843	.412	7.966	-42.155	3.563	3.657	.487	-17.099	-.020
1.500	.394	5.057	2.556	4.040	1.456	-.803	.420	1.127	-33.773	3.572	3.657	.487	-17.070	-.020
1.750	.375	4.532	2.671	4.066	1.528	-.803	.427	6.249	-25.391	3.582	3.657	.487	-17.070	-.019
2.000	.352	3.963	2.785	4.011	1.612	-.833	.435	5.451	-17.009	3.591	3.657	.487	-17.070	-.019
2.500	.310	3.204	2.917	3.957	1.691	-.803	.442	4.613	-8.627	3.601	3.657	.487	-17.070	-.018
3.000	.264	2.644	2.857	3.856	1.721	-.803	.450	3.774	-.244	3.610	3.657	.487	-17.070	-.017
4.000	.231	2.165	2.797	3.803	1.691	-.803	.450	3.774	-.244	3.610	3.657	.487	-17.070	-.017
5.000	.206	1.655	2.697	3.750	1.660	-.803	.450	3.774	-.244	3.610	3.657	.487	-17.070	-.016

Table B-11

105mm M84, B1, BE (smoke)

SPINNER 73

105MM,M84,B1,HE(SMOKE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.530	2.315	.740	2.830	.132	1.015	6.174	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.130	78.100	619.000	32.500	18.000	18.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CL-
.010	.090	2.430	1.464	3.855	.195	-.799	-.360	88.170	-844.200	2.379	3.377	.437	-9.225	-.030
.600	.090	2.430	1.464	3.880	.180	-.799	-.360	88.170	-844.200	2.379	3.377	.437	-9.225	.030
.800	.092	2.957	1.484	4.140	.041	-.799	-.215	80.117	-763.667	2.561	3.468	.510	-9.225	-.028
.900	.114	3.516	1.545	4.479	-.068	-.889	.021	58.473	-547.233	2.854	3.450	.551	-11.039	-.024
.950	.170	3.927	1.756	4.424	.311	-1.116	.200	45.850	-421.400	3.009	3.383	.617	-13.160	-.021
1.000	.310	4.327	1.975	4.173	.717	-1.025	.321	31.293	-275.433	3.143	3.422	.607	-16.635	-.020
1.050	.393	4.756	2.123	3.775	1.050	-.935	.425	18.710	-149.600	3.285	3.469	.597	-15.715	-.020
1.100	.393	5.338	2.204	3.720	1.142	-.889	.470	13.173	-94.233	3.358	3.496	.592	-16.610	-.019
1.200	.387	5.865	2.291	3.696	1.219	-.799	.495	9.247	-54.973	3.450	3.559	.582	-17.399	-.019
1.250	.373	5.261	2.473	3.593	1.377	-.799	.510	7.637	-38.867	3.468	3.559	.582	-15.880	-.019
1.500	.359	4.730	2.577	3.614	1.428	-.799	.517	6.831	-30.813	3.477	3.559	.582	-13.956	-.019
1.750	.337	4.182	2.700	3.490	1.537	-.799	.524	6.026	-22.760	3.486	3.559	.582	-13.956	-.018
2.000	.315	3.691	2.764	3.528	1.554	-.799	.532	5.221	-14.707	3.495	3.559	.582	-13.956	-.018
2.500	.283	2.930	2.932	3.630	1.592	-.799	.539	4.415	-6.653	3.504	3.559	.582	-13.956	-.017
3.000	.255	2.413	2.903	3.478	1.632	-.799	.546	3.610	1.400	3.514	3.559	.582	-13.956	-.016
4.000	.218	1.967	2.803	3.456	1.597	-.799	.546	3.610	1.400	3.514	3.559	.582	-13.956	-.016
5.000	.197	1.522	2.703	3.431	1.561	-.799	.546	3.610	1.400	3.514	3.559	.582	-13.956	-.016

Table B-12

105mm M314A1E1 (illum)

SPINNER 73

105MM,M314A1E1(ILLUM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.760	1.780	0.000	2.940	.133	1.015	3.110	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.130	87.200	756.000	35.000	18.000	15.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.204	2.954	2.061	4.000	.959	-.762	-.687	92.668	-889.178	2.038	3.138	.151	-6.097	-.031
.600	.204	2.954	2.061	4.021	.985	-.762	-.687	92.668	-889.178	2.038	3.138	.151	-6.097	-.031
.800	.207	3.536	2.081	4.102	.965	-.762	-.535	84.206	-804.556	2.238	3.238	.227	-6.097	-.030
.900	.245	4.026	2.153	4.192	.993	-.857	-.259	61.463	-577.133	2.638	3.288	.298	-9.068	-.025
.950	.302	4.547	2.[illegible]	4.258	.955	-1.055	-.002	48.241	-444.911	2.538	3.338	.436	-11.962	-.022
1.000	.440	5.137	2.240	4.327	1.017	-1.000	.096	32.903	-291.533	3.038	3.338	.398	-16.588	-.021
1.050	.527	5.684	2.[illegible]	3.855	1.285	-.904	.179	19.681	-159.311	3.138	3.338	.360	-16.830	-.021
1.100	.528	6.294	2.355	3.955	1.261	-.857	.212	13.863	-1[illegible]1.123	3.188	3.338	.341	-18.723	-.020
1.200	.529	6.932	2.427	4.052	1.254	-.762	.212	9.738	-59.880	3.218	3.338	.303	-20.593	-.020
1.350	.514	6.324	2.535	4.[illegible]22	1.275	-.762	.227	8.046	-42.956	3.235	3.338	.303	-21.918	-.020
1.500	.496	5.454	2.663	4.345	1.308	-.762	.235	7.199	-34.453	3.248	3.328	.303	-23.065	-.020
1.750	.467	5.078	2.780	4.357	1.373	-.762	.242	6.353	-26.031	3.256	3.338	.303	-23.065	-.019
2.000	.438	4.4[illegible]	2.897	4.361	1.435	-.762	.250	5.507	-17.569	3.268	3.328	.303	-23.065	-.019
2.500	.380	3.703	3.032	4.363	1.501	-.762	.257	4.661	-9.107	3.278	3.338	.303	-23.065	-.018
3.000	.323	3.084	3.016	4.302	1.514	-.762	.265	3.814	-.644	3.288	3.338	.303	-23.065	-.017
4.000	.285	2.548	2.916	4.247	1.484	-.762	.265	3.814	-.644	3.288	3.338	.303	-23.065	-.017
5.000	.263	2.012	2.816	4.185	1.454	-.762	.265	3.814	-.644	3.288	3.338	.303	-23.065	-.016

Table B-13

105mm M444 (ICM)

SPINNER 73

105MM,M444(ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.632	2.366	.456	2.841	.133	1.015	5.327	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.130	74.900	432.000	33.100	18.000	18.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.132	2.616	1.700	3.891	.551	-.787	-.404	99.165	-864.147	2.327	3.363	.411	-8.622	-.031
.600	.132	2.616	1.700	3.912	.535	-.787	-.404	99.165	-864.147	2.327	3.363	.411	-8.622	-.031
.800	.134	3.161	1.722	4.117	.447	-.787	-.256	81.930	-781.800	2.515	3.457	.485	-8.622	-.029
.900	.147	3.726	1.766	4.354	.375	-.879	.006	59.799	-560.443	2.847	3.463	.548	-10.865	-.025
.950	.220	4.150	1.953	4.368	.614	-1.111	.235	46.933	-431.827	3.054	3.438	.664	-13.280	-.021
1.000	.346	4.658	2.071	4.127	.847	-1.118	.343	32.007	-282.573	3.176	3.463	.634	-17.195	-.020
1.050	.440	5.221	2.135	3.707	1.104	-.926	.428	19.141	-153.907	3.303	3.493	.604	-16.717	-.020
1.100	.441	5.793	2.185	3.683	1.159	-.879	.464	13.479	-97.293	3.366	3.510	.569	-17.999	-.020
1.200	.436	6.348	2.276	3.631	1.245	-.787	.471	9.465	-57.149	3.438	3.551	.560	-19.195	-.020
1.350	.424	5.727	2.442	3.619	1.358	-.787	.485	7.818	-40.680	3.457	3.551	.560	-18.686	-.020
1.500	[illegible]	5.163	2.552	3.686	1.395	-.787	.493	6.595	-32.445	3.466	3.551	.560	-17.791	-.019
1.750	.385	4.587	2.677	3.657	1.472	-.787	.500	6.171	-24.211	3.476	3.551	.560	-17.791	-.019
2.000	.364	4.027	2.779	3.664	1.522	-.787	.508	5.348	-15.976	3.485	3.551	.560	-17.791	-.018
2.500	.319	3.237	2.939	3.760	1.554	-.787	.515	4.524	-7.741	3.495	3.551	.560	-17.791	-.018
3.000	.276	2.665	2.926	3.657	1.577	-.787	.522	3.701	.493	3.504	3.551	.560	-17.791	-.017
4.000	.237	2.188	2.924	3.667	1.543	-.787	.522	3.701	.493	3.504	3.551	.560	-17.791	-.016
5.000	.215	1.768	2.726	3.636	1.508	-.787	.522	3.701	.493	3.504	3.551	.560	-17.791	-.016

Table B-14

105mm XM710 (ICM)

SPINNER 73

105MM.XM710(ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.715	2.580	.467	2.94	.143	1.015	6.174	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.130	73.000	660.000	33.100	18.000	18.000	4.130	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.127	2.578	1.675	4.146	.505	-.803	-.437	91.788	-880.378	2.436	3.469	.393	-7.619	-.031
.600	.127	2.578	1.675	4.168	.492	-.863	-.437	91.788	-880.378	2.436	3.469	.393	-7.619	-.031
.800	.130	3.126	1.695	4.383	.395	-.863	-.286	83.406	-796.556	2.624	3.563	.468	-7.619	-.030
.900	.144	3.702	1.736	4.651	.277	-.897	-.025	60.878	-571.293	2.952	3.566	.526	-9.891	-.025
.950	.194	4.128	1.926	4.3[illegible]7	.775	-1.133	.192	47.781	-440.311	3.154	3.537	.631	-12.291	-.022
1.000	.241	4.628	2.050	4.006	1.026	-1.039	.305	32.588	-288.383	3.278	3.564	.606	-16.176	-.021
1.050	.433	5.208	2.094	3.245	1.407	-.945	.442	19.491	-157.411	3.406	3.595	.581	-15.674	-.020
1.100	.433	5.683	2.243	3.7[illegible]4	1.324	-.857	.441	13.728	-99.783	3.472	3.614	.559	-16.980	-.020
1.200	.425	6.241	2.317	3.805	1.337	-.863	.453	9.642	-58.920	3.544	3.657	.544	-18.250	-.020
1.350	.414	5.679	2.427	3.8[illegible]3	1.388	-.863	.468	7.966	-42.156	3.563	3.657	.544	-17.989	-.020
1.500	.394	5.097	2.558	3.917	1.449	-.863	.476	7.127	-33.773	3.572	3.657	.544	-17.636	-.020
1.750	.376	4.532	2.671	3.895	1.527	-.863	.483	6.289	-25.391	3.582	3.657	.544	-17.636	-.019
2.000	.352	3.963	2.789	3.803	1.606	-.863	.491	5.451	-17.009	3.591	3.657	.544	-17.636	-.019
2.500	.310	3.204	2.917	3.770	1.685	-.863	.498	4.613	-8.627	3.601	3.657	.544	-17.636	-.018
3.000	.265	2.644	2.897	3.66[illegible]	1.715	-.863	.506	3.774	-.244	3.610	3.657	.544	-17.636	-.017
4.000	.231	2.165	2.797	3.624	1.685	-.863	.506	3.774	-.244	3.610	3.657	.544	-17.636	-.017
5.000	.205	1.653	2.697	3.578	1.6[illegible]4	-.863	.506	3.774	-.244	3.610	3.657	.544	-17.636	-.016

Table B-15

105mm M548E1 (RA off)

SPINNER 73
105MM, M548E1(RA OFF)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.219	2.922	.554	3.28	.132	1.015	18.618	.691

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.125	67.600	846.030	28.530	18.000	18.000	4.125	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.117	2.388	1.637	3.848	.928	-.850	-.405	101.644	-978.938	2.821	3.852	.510	-9.976	-.034
.600	.117	2.388	1.637	3.873	.912	-.850	-.405	101.644	-978.938	2.821	3.852	.510	-9.976	-.034
.800	.119	2.874	1.657	4.113	.797	-.850	-.242	93.366	-896.156	3.008	3.946	.593	-9.976	-.033
.900	.138	3.382	1.765	4.671	.540	-.955	.049	67.430	-636.803	3.330	3.944	.660	-12.303	-.028
.950	.185	3.791	1.862	4.643	.787	-1.256	.303	52.933	-491.831	3.521	3.904	.783	-14.668	-.024
1.000	.289	4.216	2.011	4.334	1.125	-1.151	.424	36.116	-323.563	3.648	3.934	.753	-18.482	-.023
1.050	.344	4.683	2.116	3.979	1.400	-1.047	.524	21.619	-178.691	3.780	3.970	.722	-17.925	-.023
1.100	.340	5.203	2.165	3.913	1.475	-.955	.566	15.240	-114.903	3.849	3.951	.707	-19.476	-.022
1.200	.328	5.710	2.249	3.866	1.561	-.850	.576	10.717	-69.672	3.927	4.040	.677	-21.094	-.022
1.350	.310	5.151	2.363	3.720	1.701	-.850	.593	8.862	-51.116	3.946	4.040	.677	-21.365	-.022
1.500	.295	4.593	2.476	3.607	1.823	-.850	.602	7.934	-41.837	3.956	4.040	.677	-22.170	-.022
1.750	.271	4.022	2.597	3.425	1.961	-.850	.613	7.006	-32.559	3.965	4.040	.677	-22.170	-.021
2.000	.251	3.492	2.698	3.226	2.084	-.850	.618	6.078	-23.281	3.974	4.040	.677	-22.170	-.021
2.500	.219	2.831	2.837	2.916	2.252	-.850	.627	5.150	-14.003	3.984	4.040	.677	-22.170	-.020
3.000	.200	2.380	2.770	2.722	2.297	-.850	.635	4.222	-4.724	3.993	4.040	.677	-22.170	-.019
4.000	.162	1.962	2.670	2.708	2.266	-.850	.635	4.222	-4.724	3.993	4.040	.677	-22.170	-.018
5.000	.140	1.544	2.570	2.687	2.235	-.850	.635	4.222	-4.724	3.993	4.040	.677	-22.170	-.018

Table B-16

105mm M548E1 (RA on, launch)

SPINNER 73
105MM, M548E1(RA LAUNCH)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BODY LENGTH
5.219	2.922	.554	3.280	.132	1.015	18.618	.420

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.125	67.600	846.000	28.530	18.000	18.000	4.125	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.118	2.388	1.637	3.848	.928	-.890	-.405	101.644	-978.938	2.821	3.852	.510	-9.976	-.034
.600	.118	2.388	1.637	3.872	.912	-.890	-.405	101.644	-978.938	2.821	3.852	.510	-9.976	-.034
.800	.121	2.874	1.657	4.113	.797	-.895	-.242	92.366	-886.156	3.008	3.946	.593	-9.976	-.033
.900	.140	3.387	1.705	4.571	.540	-.995	.049	67.470	-636.803	3.330	3.944	.660	-12.303	-.028
.950	.187	3.751	1.862	4.543	.787	-1.256	.303	52.933	-491.831	3.521	3.904	.783	-14.66[illegible]	-.024
1.000	.290	4.216	2.011	4.334	1.125	-1.151	.424	36.116	-323.663	3.648	3.934	.753	-16.482	-.023
1.050	.346	4.683	2.116	3.975	1.400	-1.047	.524	21.619	-178.691	3.780	3.970	.722	-17.925	-.023
1.100	.342	5.203	2.169	3.913	1.476	-.995	.566	15.240	-114.903	3.649	3.991	.707	-19.476	-.022
1.200	.330	5.710	2.249	3.866	1.561	-.890	.576	10.717	-69.672	3.527	4.040	.677	-21.094	-.022
1.350	.312	5.151	2.363	3.730	1.701	-.890	.593	8.662	-51.116	3.546	4.040	.677	-21.365	-.022
1.500	.296	4.593	2.476	3.607	1.823	-.890	.602	7.934	-41.837	3.556	4.040	.677	-22.170	-.022
1.750	.272	4.028	2.597	3.425	1.961	-.890	.610	7.006	-32.559	3.565	4.040	.677	-22.170	-.021
2.000	.252	3.482	2.698	3.226	2.084	-.890	.618	6.078	-23.281	3.574	4.040	.677	-22.170	-.021
2.500	.221	2.831	2.837	2.916	2.252	-.890	.627	5.150	-14.003	3.584	4.040	.677	-22.170	-.020
3.000	.201	2.390	2.770	2.722	2.297	-.890	.635	4.222	-4.724	3.593	4.040	.677	-22.170	-.019
4.000	.163	1.962	2.670	2.708	2.266	-.890	.635	4.222	-4.724	3.593	4.040	.677	-22.170	-.018
5.000	.141	1.544	2.570	2.687	2.235	-.890	.635	4.222	-4.724	3.593	4.040	.677	-22.170	-.018

BEST AVAILABLE COPY

Table B-17

105mm M548E1 (RA after burn-out)

SPINNER 73
105MM, M548E1(AFTER RA)

OGIVAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.219	2.522	.554	3.220	.132	1.015	18.618	.420

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
4.125	66.000	809.400	27.500	18.000	18.000	4.125	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.118	2.388	1.637	3.750	.928	-.850	-.355	101.644	-978.938	2.821	3.852	.563	-11.190	-.034
.600	.118	2.388	1.637	3.775	.913	-.850	-.355	101.644	-978.938	2.821	3.852	.563	-11.190	-.034
.800	.121	2.874	1.657	4.014	.797	-.850	-.188	92.366	-886.156	3.008	3.946	.647	-11.190	-.033
.900	.140	3.387	1.705	4.565	.540	-.995	.109	67.430	-536.803	3.330	3.944	.720	-13.486	-.028
.950	.187	3.791	1.862	4.532	.787	-1.256	.376	52.933	-491.831	3.521	3.904	.858	-15.845	-.024
1.000	.290	4.216	2.011	4.213	1.125	-1.151	.493	36.116	-323.663	3.648	3.934	.822	-19.653	-.023
1.050	.346	4.683	2.116	3.852	1.400	-1.047	.587	21.619	-178.691	3.780	3.970	.785	-19.087	-.023
1.100	.342	5.203	2.165	3.783	1.476	-.995	.626	15.240	-114.903	3.849	3.991	.767	-20.630	-.022
1.200	.330	5.710	2.249	3.731	1.561	-.850	.630	10.717	-69.672	3.527	4.040	.730	-22.218	-.022
1.350	.312	5.151	2.363	3.588	1.701	-.850	.647	8.862	-51.116	3.546	4.040	.730	-22.337	-.022
1.500	.296	4.593	2.474	3.459	1.823	-.850	.655	7.934	-41.837	3.556	4.040	.730	-22.864	-.022
1.750	.272	4.028	2.597	3.265	1.961	-.850	.663	7.006	-32.559	3.565	4.040	.730	-22.864	-.021
2.000	.252	3.482	2.698	3.064	2.084	-.850	.672	6.078	-23.281	3.574	4.040	.730	-22.864	-.021
2.500	.221	2.831	2.827	2.745	2.252	-.850	.680	5.150	-14.003	3.584	4.040	.730	-22.864	-.020
3.000	.201	2.380	2.770	2.556	2.297	-.850	.688	4.222	-4.724	3.593	4.040	.730	-22.864	-.019
4.000	.163	1.962	2.670	2.547	2.266	-.850	.688	4.222	-4.724	3.593	4.040	.730	-22.864	-.018
5.000	.141	1.544	2.570	2.523	2.235	-.850	.688	4.222	-4.724	3.593	4.040	.730	-22.864	-.018

Table B-18

155mm M107 (HE)

SPINNER 73

155MM,M107(HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.524	2.444	.446	2.974	.096	1.014	10.747	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.052	455.200	4311.000	95.000	20.000	20.000	6.052	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(S)	CNPA(S)	CMQ	CLP
.010	.140	2.368	1.766	3.368	1.067	-.768	-.533	88.053	-843.027	2.281	3.315	.254	-5.146	-.030
.600	.140	2.368	1.766	3.390	1.054	-.768	-.533	88.053	-843.027	2.281	3.318	.264	-5.146	-.030
.800	.142	2.464	1.786	3.585	.967	-.768	-.387	86.010	-762.600	2.470	3.412	.336	-5.146	-.028
.900	.155	3.377	1.833	3.927	.832	-.859	-.147	56.395	-546.453	2.803	3.419	.382	-7.468	-.024
.950	.216	3.735	2.035	4.000	1.005	-1.065	.062	43.829	-420.787	3.012	3.356	.458	-9.902	-.021
1.000	.322	4.186	2.151	3.810	1.203	-.995	.159	31.251	-275.013	3.134	3.420	.444	-13.841	-.020
1.050	.392	4.672	2.232	3.582	1.364	-.964	.256	16.685	-149.347	3.255	3.445	.430	-13.354	-.020
1.100	.380	5.152	2.279	3.548	1.417	-.859	.301	13.155	-94.553	3.324	3.456	.423	-14.634	-.019
1.200	.371	5.654	2.359	3.597	1.443	-.768	.322	9.235	-54.845	3.393	3.506	.409	-15.836	-.019
1.350	.354	5.124	2.465	3.458	1.567	-.768	.336	7.626	-38.760	3.412	3.506	.409	-15.702	-.019
1.500	.336	4.552	2.582	3.418	1.650	-.768	.344	6.822	-30.717	3.421	3.506	.409	-15.463	-.019
1.750	.316	3.988	2.690	3.243	1.768	-.768	.351	6.017	-22.675	3.431	3.506	.409	-15.463	-.018
2.000	.295	3.451	2.772	3.116	1.850	-.768	.356	5.213	-14.632	3.440	3.506	.409	-15.463	-.018
2.500	.263	2.793	2.899	2.876	1.982	-.768	.365	4.409	-6.589	3.449	3.506	.409	-15.463	-.017
3.000	.240	2.320	2.850	2.653	2.029	-.768	.373	3.605	1.453	3.455	3.506	.409	-15.463	-.016
4.000	.202	1.857	2.750	2.681	1.999	-.768	.373	3.605	1.453	3.455	3.506	.409	-15.463	-.016
5.000	.160	1.476	2.650	2.663	1.965	-.768	.373	3.605	1.453	3.455	3.506	.409	-15.463	-.016

Table B-19

155mm M110 (WF)

SPINNER 73

155MM M110(WF)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.524	2.444	.446	2.970	.090	1.016	10.747	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.072	497.000	481.000	96.100	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.140	2.368	1.766	3.361	1.067	-.768	-.529	88.053	-843.027	2.281	3.318	.267	-5.207	-.030
.600	.140	2.368	1.766	3.383	1.054	-.768	-.529	88.053	-843.027	2.281	3.318	.267	-5.207	-.030
.800	.142	2.864	1.784	3.577	.967	-.768	-.384	80.010	-762.600	2.470	3.412	.339	-5.207	-.028
.900	.159	3.377	1.833	3.920	.832	-.459	-.144	58.395	-546.453	2.603	3.419	.386	-7.527	-.024
.950	.216	3.735	2.035	3.952	1.009	-1.085	.046	45.829	-420.787	3.012	3.356	.462	-9.961	-.021
1.000	.322	4.186	2.151	3.801	1.203	-.995	.163	31.251	-275.013	3.134	3.420	.448	-13.899	-.020
1.050	.382	4.672	2.232	3.573	1.369	-.964	.262	18.685	-149.347	3.259	3.449	.433	-13.452	-.020
1.100	.380	5.192	2.279	3.539	1.417	-.859	.304	13.155	-94.053	3.324	3.466	.426	-14.491	-.019
1.200	.371	5.654	2.356	3.588	1.443	-.768	.325	9.235	-54.845	3.393	3.506	.412	-15.852	-.019
1.350	.354	5.124	2.465	3.459	1.567	-.768	.339	7.626	-38.760	3.412	3.506	.412	-15.748	-.019
1.500	.335	4.552	2.582	3.407	1.650	-.768	.347	6.822	-30.717	3.421	3.506	.412	-15.490	-.015
1.750	.316	3.988	2.690	3.232	1.768	-.768	.354	6.017	-22.675	3.431	3.506	.412	-15.490	-.018
2.000	.295	3.451	2.772	3.105	1.856	-.768	.361	5.213	-14.632	3.440	3.506	.412	-15.490	-.018
2.500	.263	2.793	2.899	2.869	1.982	-.768	.368	4.409	-.589	3.449	3.506	.412	-15.490	-.017
3.000	.240	2.320	2.850	2.681	2.029	-.768	.376	3.605	1.453	3.455	3.506	.412	-15.490	-.016
4.000	.202	[illegible]	2.750	2.670	1.999	-.768	.376	3.605	1.453	3.455	3.506	.412	-15.490	-.016
5.000	.180	1.475	2.650	2.652	1.965	-.768	.376	3.605	1.453	3.455	3.506	.412	-15.490	-.016

Table B-20

155mm M110 (Gas)

SPINNER 7

155MM.M110(GAS)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.524	2.444	.444	3.0[illegible]0	.090	1.016	10.747	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	461.000	4424.000	95.000	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPAS	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.140	2.366	1.766	3.414	1.067	-.768	-.552	88.053	-843.027	2.281	3.318	.244	-4.750	-.030
.600	.140	2.366	1.766	3.436	1.054	-.768	-.552	88.053	-843.027	2.281	3.318	.244	-4.750	-.030
.800	.142	2.864	1.786	3.651	.967	-.768	-.407	80.010	-762.600	2.470	3.412	.316	-4.750	-.028
.900	.155	3.377	1.837	3.975	.872	-.859	-.17[illegible]	58.395	-546.453	2.803	3.419	.360	-7.084	-.024
.950	.216	3.735	2.035	4.053	1.005	-1.065	.013	45.829	-420.787	3.012	3.336	.430	-9.522	-.021
1.000	.322	4.166	2.151	3.866	1.203	-.955	.133	31.251	-275.013	3.134	3.420	.418	-13.463	-.020
1.050	.382	4.672	2.232	3.646	1.365	-.914	.234	18.885	-149.347	3.255	3.449	.406	-13.020	-.020
1.100	.380	5.152	2.275	3.608	1.417	-.859	.274	13.155	-94.053	3.324	3.466	.400	-14.262	-.019
1.200	.371	5.654	2.358	3.656	1.443	-.768	.307	9.235	-54.845	3.393	3.506	.389	-15.475	-.019
1.350	.354	5.124	2.465	3.532	1.567	-.768	.310	7.626	-38.760	3.412	3.505	.389	-15.408	-.019
1.500	.336	4.552	2.582	3.465	1.650	-.768	.324	6.822	-30.717	3.421	3.506	.389	-15.289	-.019
1.750	.316	3.926	2.690	3.313	1.768	-.768	.331	6.017	-22.675	3.431	3.506	.389	-15.289	-.018
2.000	.295	3.451	2.772	3.188	1.854	-.768	.338	5.213	-14.632	3.440	3.506	.389	-15.289	-.018
2.500	.263	2.793	2.855	2.952	1.982	-.768	.344	4.409	-6.589	3.449	3.506	.389	-15.289	-.017
3.000	.240	2.320	2.850	2.742	2.026	-.768	.353	3.605	1.453	3.459	3.506	.389	-15.289	-.016
4.000	.202	1.857	2.750	2.752	1.999	-.768	.353	3.605	1.453	3.459	3.506	.389	-15.289	-.016
5.000	.180	1.475	2.650	2.722	1.966	-.768	.353	3.605	1.453	3.459	3.506	.389	-15.289	-.016

Table B-21

155mm M116 (wht smoke)

SPINNER 73

155MM,M116(WHT SMOKE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.524	2.444	.446	3.0 0	.090	1.016	10.747	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	491.000	4424.000	95.000	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CY2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNP35	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.140	2.366	1.766	3.414	1.067	-.768	-.552	88.053	-843.027	2.291	3.318	.244	-4.750	-.030
.600	.140	2.366	1.766	3.436	1.054	-.768	-.552	88.053	-843.027	2.291	3.318	.244	-4.750	-.030
.800	.142	2.864	1.786	3.631	.967	-.768	-.407	80.010	-762.600	2.470	3.412	.316	-4.750	-.028
.900	.159	3.377	1.833	3.975	.932	-.859	-.170	59.395	-546.453	2.603	3.419	.360	-7.084	-.024
.950	.216	3.735	2.035	4.053	1.005	-1.085	.013	45.129	-420.787	3.012	3.356	.430	-9.522	-.021
1.000	.322	4.186	2.151	3.865	1.293	-.995	.133	31.251	-215.013	3.134	3.420	.418	-13.463	-.020
1.050	.382	4.672	2.232	3.645	1.365	-.964	.234	19.685	-149.347	3.259	3.449	.406	-13.020	-.020
1.100	.380	5.152	2.279	3.608	1.417	-.859	.278	13.155	-94.053	3.324	3.466	.400	-14.262	-.015
1.200	.371	5.694	2.356	3.655	1.443	-.768	.302	9.235	-54.845	3.393	3.506	.389	-15.475	-.015
1.350	.354	5.124	2.465	3.532	1.567	-.768	.316	7.626	-38.750	3.412	3.506	.389	-15.408	-.019
1.500	.334	4.552	2.562	3.465	1.650	-.768	.324	6.822	-30.717	3.421	3.506	.389	-15.289	-.019
1.750	.316	3.988	2.690	3.313	1.768	-.768	.331	6.017	-22.675	3.431	3.506	.389	-15.289	-.018
2.000	.295	3.451	2.772	3.188	1.855	-.768	.338	5.213	-14.632	3.440	3.506	.389	-15.289	-.018
2.500	.263	2.793	2.899	2.952	1.982	-.768	.345	4.409	-6.589	[illegible]	3.506	.389	-15.289	-.017
3.000	.240	2.326	2.850	2.767	2.035	-.768	.353	3.605	1.453	[illegible]	3.506	.389	-15.289	-.016
4.000	.202	1.897	2.750	2.752	1.999	-.768	.353	3.605	1.453	[illegible]	3.506	.389	-15.289	-.016
5.000	.180	1.475	2.650	2.732	1.965	-.768	.353	3.605	1.453	[illegible]	3.506	.389	-15.289	-.016

Table B-22

155mm M116 (clrd smoke)

SPINNER 7)
155MM.M116(CLRD SMOKE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.574	2.444	.444	3.000	.090	1.016	10.747	0.030

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	447.000	4024.000	86.400	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA		CPN	CYPA	CNPA	CNPA3	CNPAS	CPF(1)	CPF(5)	CNFA(5)	CMQ	CLP
.010	.140	2.368	1.766	3.414	1.067	-.768	-.352	88.053	-843.027	2.281	3.318	.244	-4.750	-.030
.600	.140	2.368	1.766	3.436	1.054	-.764	-.552	88.053	-843.027	2.281	3.318	.244	-4.750	-.030
.800	.142	2.864	1.786	3.631	.967	-.768	-.407	80.010	-762.600	2.470	3.412	.316	-4.750	-.028
.900	.155	3.377	1.833	3.975	.832	-.859	-.170	58.395	-546.453	2.603	3.419	.360	-7.084	-.024
.950	.216	3.735	2.035	4.053	1.009	-1.065	.013	45.229	-420.787	3.012	3.396	.430	-9.522	-.021
1.000	.322	4.186	2.151	3.066	1.293	-.957	.133	31.251	-275.013	3.134	3.420	.418	-13.463	-.020
1.050	.342	4.672	2.232	3.640	1.365	-.904	.234	18.685	-149.347	3.259	3.449	.406	-13.020	-.020
1.100	.380	5.192	2.279	3.608	1.417	-.859	.276	13.155	-94.053	3.324	3.466	.400	-14.262	-.019
1.200	[illegible]	5.654	2.350	3.656	1.443	-.768	.362	9.235	-54.845	3.393	3.506	.389	-15.475	-.019
1.250	.354	5.124	2.465	3.532	1.567	-.768	.316	7.626	-38.760	3.412	3.515	.389	-15.408	-.019
1.500	[illegible]	4.55[illegible]	2.582	3.445	1.657	-.768	.324	6.822	-30.717	3.421	3.506	.389	-15.289	-.019
1.750	.316	3.988	2.690	3.313	1.768	-.768	.331	6.017	-22.675	3.431	3.506	.389	-15.289	-.018
2.000	.295	3.451	2.772	3.188	1.850	-.768	.338	5.213	-14.632	3.440	3.506	.389	-15.289	-.018
2.500	.263	2.793	2.855	2.992	1.982	-.768	.345	4.409	-6.589	3.449	3.506	.389	-15.289	-.017
3.000	.240	2.320	2.850	2.767	2.025	-.768	.353	3.605	1.453	3.455	3.506	.385	-15.285	-.016
4.000	.202	1.857	2.750	2.752	1.999	-.768	.353	3.605	1.453	3.459	3.506	.389	-15.286	-.016
5.000	.180	1.475	2.650	2.733	1.965	-.768	.354	3.605	1.453	3.455	3.506	.389	-15.289	-.016

Table B-23

135mm M121, M121A1 (chemical)

SPINNER 73

155MM M121,A1(CHEMICAL)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.524	2.444	.446	2.974	.090	1.016	10.747	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	515.000	4643.000	99.700	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.140	2.368	1.766	3.368	1.067	-.768	-.532	88.053	-843.027	2.281	3.318	.264	-5.146	-.030
.600	.140	2.308	1.766	3.390	1.054	-.768	-.532	88.053	-843.027	2.281	3.318	.264	-5.146	-.030
.800	.142	2.864	1.786	3.585	.967	-.768	-.387	80.010	-762.600	2.470	3.412	.336	-5.146	-.028
.900	.159	3.377	1.833	3.927	.832	-.859	-.147	58.395	-546.653	2.803	3.419	.382	-7.468	-.024
.950	.216	3.735	2.035	4.000	1.009	-1.085	.042	45.829	-420.787	3.012	3.396	.458	-9.902	-.021
1.000	.322	4.186	2.151	3.810	1.203	-.995	.159	31.251	-275.013	3.134	3.420	.444	-13.841	-.020
1.050	.382	4.672	2.232	3.582	1.369	-.904	.258	18.685	-149.347	3.259	3.449	.430	-13.394	-.020
1.100	.380	5.192	2.279	3.548	1.417	-.859	.301	13.155	-94.053	3.324	3.466	.423	-14.634	-.019
1.200	.371	5.694	2.350	3.597	1.443	-.768	.322	9.235	-54.845	3.393	3.506	.409	-15.836	-.019
1.350	.354	5.124	2.465	3.468	1.567	-.768	.336	7.626	-38.760	3.412	3.506	.409	-15.702	-.019
1.500	.339	4.552	2.532	3.418	1.650	-.768	.344	6.822	-30.717	3.421	3.506	.409	-15.463	-.019
1.750	.316	3.988	2.690	3.243	1.768	-.768	.351	6.017	-22.675	3.431	3.506	.409	-15.463	-.018
2.000	.295	3.451	2.772	3.116	1.850	-.768	.358	5.213	-14.632	3.440	3.506	.409	-15.463	-.018
2.500	.263	2.793	2.899	2.876	1.982	-.768	.365	4.409	-6.589	3.449	3.506	.409	-15.463	-.017
3.000	.240	2.320	2.850	2.693	2.029	-.768	.373	3.605	1.453	3.459	3.506	.409	-15.463	-.016
4.000	.202	1.897	2.750	2.681	1.999	-.768	.373	3.605	1.453	3.459	3.506	.409	-15.463	-.016
5.000	.180	1.475	2.650	2.663	1.969	-.768	.373	3.605	1.453	3.459	3.506	.409	-15.463	-.016

Table B-24

155mm M485E1, M485E2 (illum)

SPINNER 73
155MM,M485E1,E2(ILLUM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BASE DIAMETER	NOSE RADIUS	ECOM LENGTH
4.518	2.502	.488	2.928	.090	1.015	11.226	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.095	487.000	3640.000	90.000	20.000	20.000	6.095	59.000	.00238

AERODYNAMIC COEFFICIENTS (NOTE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPAS	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.132	2.336	1.731	3.238	1.045	-.772	-.477	87.935	-841.853	2.310	3.340	.318	-5.022	-.030
.600	.132	2.336	1.731	3.290	1.032	-.772	-.477	87.935	-841.853	2.310	3.340	.318	-6.022	-.030
.800	.134	2.822	1.751	3.432	.935	-.772	-.332	79.503	-761.533	2.497	3.424	.391	-6.022	-.028
.900	.154	3.345	1.798	3.855	.784	-.862	-.085	58.317	-545.673	2.824	3.438	.439	-8.258	-.024
.950	.210	3.762	2.005	3.866	1.003	-1.088	.107	45.767	-420.173	3.026	3.408	.523	-10.645	-.021
1.000	.318	4.140	2.127	3.637	1.217	-.958	.221	31.209	-274.593	3.145	3.435	.506	-14.515	-.020
1.050	.378	4.624	2.219	3.410	1.351	-.967	.317	18.659	-149.053	3.277	3.466	.488	-13.996	-.020
1.100	.375	5.140	2.265	3.370	1.443	-.862	.356	13.137	-93.873	3.343	3.485	.480	-15.180	-.019
1.200	.365	5.637	2.340	3.418	1.467	-.772	.376	9.222	-54.717	3.415	3.528	.463	-16.308	-.019
1.350	.348	5.067	2.458	3.273	1.59[illegible]	-.772	.391	7.615	-39.653	3.434	3.528	.463	-15.912	-.019
1.500	.333	4.502	2.572	3.215	1.678	-.772	.398	6.812	-30.621	3.443	3.528	.463	-15.314	-.019
1.750	.310	3.941	2.682	3.035	1.797	-.772	[illegible]	6.009	-22.589	3.453	3.528	.463	-15.314	-.018
2.000	.290	3.413	2.758	2.910	1.873	-.772	.412	5.206	-14.557	3.462	3.528	.463	-15.314	-.018
2.500	.259	2.751	2.885	2.672	2.003	-.772	.419	4.403	-6.525	3.472	3.528	.463	-15.314	-.017
3.000	.237	2.284	2.839	2.451	2.051	-.772	.427	3.599	1.507	3.481	3.528	.463	-15.314	-.016
4.000	.195	1.967	2.739	2.486	2.020	-.772	.427	3.599	1.507	3.481	3.528	.463	-15.314	-.016
5.000	.177	1.456	2.639	2.474	1.950	-.772	.427	3.599	1.507	3.481	3.528	.463	-15.314	-.016

Table B-25

155mm M449E1 (ICM)

SPINNER 77

155MM M449E1(ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.518	2.502	.488	2.992	.090	1.016	11.226	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.095	475.000	3593.000	95.500	20.000	20.000	6.095	59.000	.00239

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.132	2.336	1.731	3.365	1.045	-.772	-.526	87.935	-841.853	2.310	3.340	.269	-5.040	-.030
.600	.132	2.336	1.731	3.351	1.032	-.772	-.526	87.935	-841.853	2.310	3.340	.269	-5.040	-.030
.800	.134	2.832	1.751	3.594	.439	-.774	-.382	79.903	-761.533	2.497	3.434	.341	-5.040	-.026
.900	.154	3.345	1.758	3.970	.784	-.662	-.149	59.317	-545.673	2.824	3.438	.384	-7.308	-.024
.950	.210	3.702	2.065	3.957	1.003	-1.088	.037	45.767	-420.173	3.026	3.408	.453	-9.701	-.021
1.000	.318	4.140	2.137	3.754	1.217	-.958	.157	31.209	-274.593	3.149	3.435	.442	-13.578	-.020
1.050	.378	4.624	2.219	3.552	1.391	-.907	.259	19.659	-149.053	3.[illegible]7	3.466	.420	-13.059	-.020
1.100	.375	5.140	2.269	3.519	1.443	-.842	.303	13.137	-93.873	3.343	3.485	.425	-14.257	-.019
1.200	.365	5.637	2.340	3.557	1.467	-.772	.327	9.222	-54.717	3.415	3.528	.413	-15.412	-.019
1.350	.348	5.067	2.458	3.431	1.556	-.772	.341	7.615	-38.653	3.434	3.528	.413	-15.179	-.019
1.500	.333	4.562	2.572	3.325	1.676	-.772	.346	6.812	-30.621	3.443	3.528	.413	-14.878	-.019
1.750	.310	3.951	2.682	3.216	1.797	-.772	.356	6.009	-22.589	3.453	3.528	.413	-14.878	-.018
2.000	.290	3.413	2.758	3.037	1.873	-.772	.363	5.206	-14.557	3.462	3.528	.413	-14.878	-.018
2.500	.255	2.751	2.885	2.857	2.003	-.772	.370	4.403	-6.525	3.472	3.528	.413	-14.878	-.017
3.000	.237	2.284	2.835	2.673	2.051	-.774	.377	3.599	1.507	3.481	3.528	.413	-14.878	-.016
4.000	.199	1.867	2.739	2.651	2.020	-.774	.377	3.599	1.507	3.481	3.528	.413	-14.878	-.016
5.000	.177	1.456	2.635	2.643	1.990	-.772	.377	3.599	1.507	3.481	3.528	.413	-14.878	-.016

Table B-26

155mm M449E2 (ICM)

SPINNER 73
155MM,M449E2(ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.518	2.502	.488	2.984	.090	1.016	11.226	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.055	485.000	3653.000	96.100	20.000	20.000	6.095	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(I)	CPF(S)	CNPA(S)	CMQ	CLP
.010	.132	2.336	1.731	3.355	1.045	-.772	-.520	87.935	-841.853	2.310	3.340	.275	-5.163	-.030
.600	.132	2.336	1.731	3.377	1.032	-.772	-.520	87.935	-841.853	2.310	3.340	.275	-5.163	-.030
.800	.134	2.832	1.751	3.583	.939	-.772	-.376	79.903	-761.533	2.497	3.434	.347	-5.163	-.028
.900	.154	3.349	1.798	3.956	.784	-.862	-.130	58.317	-545.673	2.624	3.438	.391	-7.427	-.024
.950	.214	3.762	2.005	3.561	1.003	-1.088	.040	45.767	-420.173	3.026	3.408	.462	-9.819	-.021
1.000	.316	4.140	2.137	3.777	1.217	-.958	.169	31.209	-274.593	3.149	3.435	.450	-13.695	-.020
1.050	.372	-4.624	2.219	3.534	1.351	-.917	.266	18.659	-149.093	3.277	3.466	.438	-13.185	-.020
1.100	.375	5.140	2.265	3.497	1.443	-.862	.311	13.137	-93.873	3.343	3.485	.432	-14.372	-.019
1.200	.365	5.637	2.346	3.549	1.467	-.772	.333	9.222	-54.717	3.415	3.528	.420	-15.524	-.019
1.250	.346	5.067	2.458	3.411	1.556	-.772	.347	7.615	-38.653	3.434	3.528	.420	-15.270	-.019
1.500	.333	4.502	2.572	3.456	1.678	-.772	.355	6.812	-30.621	3.443	3.528	.420	-14.932	-.019
1.750	.310	3.941	2.682	3.185	1.797	-.772	.362	6.009	-22.589	3.453	3.528	.420	-14.932	-.018
2.000	.290	3.413	2.758	3.065	1.873	-.772	.365	5.206	-14.557	3.462	3.528	.420	-14.932	-.018
2.500	.255	2.751	2.889	2.834	2.003	-.772	.376	4.403	-6.525	3.472	3.528	.420	-14.932	-.017
3.000	.237	2.264	2.839	2.650	2.051	-.772	.382	3.599	1.507	3.481	3.528	.420	-14.932	-.016
4.000	.199	1.867	2.739	2.639	2.020	-.772	.382	3.599	1.507	3.481	3.528	.420	-14.932	-.016
5.000	.177	1.650	2.635	2.622	1.995	-.772	.382	3.599	1.507	3.481	3.528	.420	-14.932	-.016

Table B-27

155mm M483E1 (ICM)

SPINNER 73

155MM.M483E1(ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BODY LENGTH
5.600	2.842	.255	3.647	.098	1.016	9.478	6.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.095	546.000	5866.000	103.000	20.000	20.000	6.095	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(4)	CNPA(5)	CMQ	C
.010	.186	2.787	1.894	4.785	1.112	-.954	-.618	113.006	-1092.556	2.992	4.063	.403	-11.859	[illegible]
.600	.189	2.787	1.894	4.911	1.110	-.954	-.618	113.006	-1092.556	2.992	4.063	.403	-11.859	[illegible]
.800	.191	3.312	1.914	4.946	1.033	-.954	-.432	102.694	-999.444	3.167	4.160	.496	-11.859	[illegible]
.900	.213	3.853	1.945	5.309	.910	-1.070	-.095	74.983	-712.333	3.550	4.184	.582	-14.781	[illegible]
.950	.256	4.334	2.034	5.130	1.118	-1.360	.216	54.872	-551.222	3.799	4.191	.749	-17.457	[illegible]
1.000	.360	4.905	2.093	4.587	1.306	-1.244	.338	46.183	-364.333	3.912	4.206	.703	-21.734	[illegible]
1.050	.394	5.495	2.131	4.469	1.543	-1.128	.437	24.072	-203.222	4.028	4.223	.657	-21.662	[illegible]
1.100	.398	6.095	2.166	4.485	1.571	-1.070	.476	16.983	-132.333	4.087	4.233	.635	-23.956	[illegible]
1.200	.385	6.702	2.250	4.537	1.623	-.954	.477	11.957	-82.667	4.141	4.257	.589	-26.463	[illegible]
1.350	.375	6.037	2.440	4.841	1.656	-.954	.495	9.894	-61.444	4.160	4.257	.589	-28.686	[illegible]
1.500	.355	5.507	2.496	4.680	1.765	-.954	.503	8.863	-51.133	4.170	4.257	.589	-32.195	[illegible]
1.750	.334	4.907	2.621	4.747	1.829	-.954	.514	7.832	-40.822	4.179	4.257	.589	-32.195	[illegible]
2.000	.312	4.262	2.792	4.857	1.886	-.954	.524	6.801	-30.511	4.189	4.257	.589	-32.195	[illegible]
2.500	.270	3.549	2.914	4.788	1.997	-.954	.533	5.770	-20.200	4.199	4.257	.589	-32.195	[illegible]
3.000	.232	2.972	2.886	4.596	2.047	-.954	.542	4.739	-9.889	4.209	4.257	.589	-32.195	-.021
4.000	.195	2.467	2.786	4.521	2.017	-.954	.542	4.739	-9.889	4.209	4.257	.589	-32.195	[illegible]
5.000	.173	1.961	2.684	4.435	1.987	-.954	.542	4.739	-9.889	4.209	4.257	.589	-32.195	-.020

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Table B-28

155mm XM708E2 (HE)

SPINNER 7?

155MM,XM708E2(HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.252	3.015	.553	3.2??	.09?	1.018	18.877	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	508.000	4860.000	96.000	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CMQ	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(S)	CNPA(S)	CMG	C?-
.010	.112	2.388	1.585	4.063	[illegible]	-.916	-.446	103.071	-593.213	2.500	3.928	.492	-9.212	[illegible]
.600	.112	2.388	1.585	4.0??	[illegible]	-.916	-.446	103.071	-593.213	2.500	3.928	.492	-9.212	[illegible]
.800	.115	2.876	1.605	4.341	.588	-.916	-.271	93.663	-555.133	3.087	4.021	.570	-9.212	-.032
.900	.135	3.352	1.661	4.9??	.957	-1.012	.018	6?.374	-646.?53	3.402	4.015	.638	-11.533	[illegible]
.950	.181	3.804	1.818	4.834	.724	-1.270	.25?	52.679	-495.253	3.588	3.965	.746	-13.867	-.?4
1.000	.285	4.218	1.979	4.564	1.1?5	-1.171	.34?	36.627	-378.773	3.717	4.001	.722	-17.631	-.?3
1.0??	.343	4.682	2.091	4.0??	1.459	-1.165	.49?	21.927	-181.773	3.851	4.040	.657	-17.028	-.??3
1.1??	.33?	5.202	2.14?	3.961	1.541	-1.?1?	.54?	15.459	-117.?53	3.921	4.062	.685	-18.588	-.?3
1.200	.?2?	5.767	2.229	3.9?9	1.6?1	-.9?6	.55?	1?.873	-71.229	4.002	4.115	.661	-20.250	-.022
1.250	.30?	5.150	2.349	3.767	1.779	-.9?5	.57?	?.551	-52.413	4.?21	4.115	.661	-20.654	-.022
1.500	.282	4.55?	2.457	3.665	1.893	-.9?6	.5??	?.051	-43.005	4.030	4.115	.661	-21.?10	-.022
1.750	.2??	4.031	2.5??	3.???	2.??9	-.9??	.5??	7.11?	-3?.?57	4.040	4.115	.661	-21.?10	-.022
2.000	.24?	3.465	2.6??	3.?15	2.152	-.9?5	.6?2	6.169	-24.1?9	4.?45	4.115	.661	-21.?10	-.??1
2.500	.217	2.828	2.828	3.?1?	2.?15	-.9??	.61?	5.22?	-14.7?1	4.?55	4.115	.661	-21.?10	-.0?0
3.000	.19?	2.386	2.755	2.661	2.?7?	-.9?6	.619	4.257	-5.373	4.068	4.115	.661	-21.?10	-.019
4.000	.1?0	1.963	2.6??	2.7??	2.?3?	-.9??	.619	4.287	-5.373	4.?66	4.115	.661	-21.?10	-.019
5.000	.13?	1.56?	2.556	2.755	2.3?7	-.9?6	.619	4.257	-5.373	4.066	4.115	.661	-21.?10	-.01?

Table B-29

155mm XM708E3 (HE)

SPINNER 7[illegible]

155MM XM708E3(HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.648	3.119	.592	3.523	.090	1.016	18.877	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	517.000	6085.000	96.000	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CMQ	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CPG	CLP
.010	.111	2.455	1.567	4.366	.737	-.963	-.412	110.033	-1062.831	3.695	4.128	.582	-12.674	-.037
.600	.111	2.455	1.567	4.392	.720	-.963	-.412	110.033	-1062.831	3.695	4.128	.582	-12.674	-.037
.800	.113	2.983	1.587	4.666	.587	-.963	-.231	99.592	-962.422	3.282	4.222	.673	-12.674	-.035
.900	.132	3.504	1.627	5.316	.277	-1.076	.084	71.007	-692.573	3.601	4.21[illegible]	.745	-15.048	-.030
.950	.174	3.965	1.744	5.274	.495	-1.358	.351	57.318	-535.684	3.786	4.168	.877	-17.379	-.026
1.000	.281	4.397	1.964	4.907	.445	-1.245	.444	39.114	-353.653	3.919	4.201	.844	-21.139	-.025
1.050	.336	4.858	2.040	4.453	1.341	-1.132	.597	23.430	-196.804	4.050	4.240	.812	-20.541	-.024
1.100	.333	5.345	2.097	4.375	1.435	-1.176	.645	16.527	-127.773	4.121	4.262	.795	-22.322	-.024
1.200	.322	5.426	2.184	4.256	1.562	-.963	.655	11.637	-78.824	4.203	4.315	.763	-24.253	-.024
1.300	.305	5.366	2.315	4.157	1.727	-.963	.673	9.624	-58.742	4.222	4.315	.763	-25.008	-.024
1.500	.260	4.863	2.426	4.032	1.847	-.963	.682	8.620	-48.761	4.231	4.315	.763	-26.804	-.024
1.750	.266	4.234	2.547	3.925	1.944	-.963	.691	7.615	-38.660	4.240	4.315	.763	-26.804	-.023
2.000	.242	3.666	2.686	3.687	2.152	-.963	.700	6.612	-28.620	4.250	4.315	.763	-26.804	-.023
2.500	.214	2.955	2.826	3.362	2.337	-.963	.709	5.608	-18.579	4.259	4.315	.763	-26.804	-.022
3.000	.194	2.525	2.770	3.144	2.386	-.963	.718	4.604	-8.538	4.268	4.315	.763	-26.804	-.021
4.000	.156	2.094	2.676	3.117	2.364	-.963	.718	4.604	-8.538	4.268	4.315	.763	-26.804	-.020
5.000	.134	1.455	2.626	3.074	2.326	-.963	.718	4.604	-8.538	4.268	4.315	.763	-26.804	-.015

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Table B-30

155mm XM549 (RA, launch)

SPINNER 73
155MM, M549(RA LAUNCH)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.645	3.014	.579	3.529	.090	1.016	18.877	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	505.500	6610.000	96.000	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.114	2.502	1.582	4.359	.772	-.961	-.424	109.974	-1062.244	3.087	4.321	.570	-12.448	-.037
.600	.114	2.502	1.582	4.384	.756	-.961	-.424	109.974	-1062.[illegible]	3.087	4.321	.570	-12.448	-.037
.800	.116	2.990	1.602	4.645	.626	-.961	-.243	99.539	-961.[illegible]	3.275	4.215	.660	-12.448	-.035
.900	.135	3.508	1.652	5.291	.324	-1.074	.071	72.968	-692.183	3.594	4.209	.752	-14.845	-.030
.950	.180	3.964	1.76[illegible]	5.266	.534	-1.356	.344	57.238	-535.378	3.782	4.165	.864	-17.191	-.026
1.000	.283	4.400	1.917	4.904	.979	-1.243	.475	39.098	-353.483	3.910	4.156	.831	-20.973	-.025
1.050	.337	4.863	2.048	4.462	1.349	-1.130	.584	23.418	-196.678	4.045	4.235	.799	-20.397	-.024
1.100	.334	5.401	2.103	4.391	1.441	-1.074	.630	16.518	-127.683	4.115	4.257	.783	-22.194	-.024
1.200	.324	5.933	2.193	4.302	1.566	-.961	.642	11.626	-78.750	4.196	4.309	.750	-24.144	-.024
1.350	.306	5.374	2.309	4.171	1.722	-.961	.66[illegible]	9.619	-58.689	4.215	4.309	.750	-24.960	-.024
1.500	.291	4.809	2.433	4.086	1.848	-.961	.669	8.615	-48.653	4.224	4.309	.750	-26.828	-.024
1.750	.267	4.239	2.561	3.940	1.985	-.961	.678	7.612	-38.616	4.233	4.309	.750	-26.828	-.023
2.000	.247	3.669	2.688	3.703	2.150	-.961	.687	6.608	-28.582	4.243	4.309	.750	-26.828	-.023
2.500	.215	3.004	2.837	3.378	2.337	-.961	.696	5.605	-18.547	4.252	4.309	.750	-26.828	-.022
3.000	.194	2.534	2.771	3.164	2.386	-.961	.705	4.601	-8.511	4.262	4.309	.750	-26.828	-.020
4.000	.156	2.055	2.671	3.133	2.355	-.961	.705	4.601	-8.511	4.262	4.309	.750	-26.828	-.020
5.000	.134	1.663	2.571	3.055	2.324	-.961	.705	4.601	-8.511	4.262	4.309	.750	-26.828	-.019

Table B-31

155mm XM549 (RA, after burn-out)

SPINNER 73
155MM, M549(AFTER RA)

INITIAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.645	3.014	.579	3.510	.090	1.014	18.877	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.092	483.000	6270.000	89.200	20.000	20.000	6.092	59.000	.00238

AERODYNAMIC COEFFICIENTS RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	C..
.010	.114	2.502	1.582	4.330	.772	-.961	-.407	109.574	-1062.244	3.087	4.121	.587	-12.864	-.037
.600	.114	2.502	1.582	4.356	.756	-.961	-.407	109.574	-1062.244	3.087	4.121	.587	-12.864	-.037
.800	.116	2.990	1.602	4.620	.62[illegible]	-.961	-.226	99.939	-961.889	3.275	4.215	.677	-12.864	[illegible]
.900	.135	3.506	1.652	5.261	.324	-1.174	.091	72.968	-692.183	3.594	4.209	.751	-15.252	[illegible]
.950	.180	3.964	1.76[illegible]	5.234	.534	-1.356	.365	57.288	-535.278	3.78[illegible]	4.165	.888	-17.556	[illegible]
1.000	.283	4.400	1.917	4.870	.970	-1.243	.499	39.098	-353.483	3.910	4.196	.854	-21.377	-.025
1.050	.337	4.863	2.048	4.425	1.349	-1.130	.605	23.418	-196.678	4.045	4.235	.819	-20.798	-.024
1.100	.334	5.401	2.102	4.352	1.441	-1.074	.649	16.518	-127.683	4.115	4.257	.802	-22.592	-.024
1.200	.324	5.933	2.197	4.263	1.566	-.961	.655	11.626	-78.760	4.196	4.309	.767	-24.532	-.024
1.350	.306	5.374	2.309	4.130	1.722	-.961	.677	9.619	-58.689	4.215	4.309	.767	-25.303	[illegible]
1.500	.291	4.805	2.437	4.042	1.848	-.961	.688	8.615	-48.653	4.224	4.309	.767	-27.087	-.024
1.750	.267	4.235	2.567	3.894	1.989	-.961	.695	7.612	-38.618	4.233	4.309	.767	-27.087	-.023
2.000	.247	3.669	2.688	3.655	2.15[illegible]	-.961	.704	6.608	-28.582	4.243	4.309	.767	-27.087	-.023
2.500	.215	3.004	2.837	3.327	2.337	-.961	.713	5.605	-18.547	4.252	4.309	.767	-27.087	-.022
3.000	.194	2.534	2.771	3.115	2.38[illegible]	-.961	.722	4.601	-8.511	4.262	4.309	.767	-27.087	-.020
4.000	.156	2.056	2.671	3.084	2.355	-.961	.722	4.601	-8.511	4.262	4.309	.767	-27.087	-.019
5.000	.134	1.663	2.571	3.048	2.324	-.961	.722	4.601	-8.511	4.262	4.309	.767	-27.087	-.019

Table B-32

155mm XM454 (atomic)

SPINNER 73
155MM, M454(ATOMIC)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.578	2.090	0.000	3.577	.131	1.016	5.849	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.052	694.700	6707.000	120.500	20.000	20.000	6.052	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMC	[illegible]
.010	.212	2.845	2.164	4.432	1.530	-.892	-.903	108.664	-1049.142	2.565	3.665	.079	-8.019	[illegible]
.600	.212	2.846	2.164	4.452	1.523	-.892	-.903	108.664	-1049.142	2.565	3.665	.079	-8.019	[illegible]
.800	.214	3.330	2.184	4.536	1.500	-.892	-.724	98.748	-949.978	2.765	3.765	.168	-8.019	[illegible]
.900	.254	3.787	2.231	4.728	1.458	-1.004	-.413	72.697	-683.473	3.165	3.815	.239	-11.301	-.020
.950	.315	4.263	2.267	4.846	1.433	-1.263	-.143	56.663	-524.529	3.465	3.865	.372	-14.245	[illegible]
1.000	.409	4.832	2.294	4.945	1.419	-1.171	-.014	38.629	-348.793	3.565	3.865	.338	-18.922	[illegible]
1.050	.453	5.357	2.374	4.972	1.482	-1.060	.094	23.135	-193.845	3.665	3.865	.306	-19.248	-.024
1.100	.449	5.946	2.394	5.051	1.467	-1.004	.135	16.317	-122.673	3.715	3.865	.290	-21.714	[illegible]
1.200	.440	6.583	2.455	5.152	1.478	-.852	.150	11.483	-77.331	3.745	3.865	.257	-24.386	[illegible]
1.350	.419	5.991	2.546	5.228	1.524	-.852	.168	9.500	-57.458	3.765	3.865	.257	-27.332	[illegible]
1.500	.399	5.380	2.658	5.304	1.581	-.852	.177	8.508	-47.581	3.775	3.865	.257	-31.432	[illegible]
1.750	.369	4.776	2.761	5.295	1.659	-.852	.186	7.516	-37.665	3.785	3.865	.257	-31.432	[illegible]
2.000	.341	4.172	2.865	5.262	1.746	-.852	.195	6.525	-27.748	3.795	3.865	.257	-31.432	-.022
2.500	.294	3.556	2.973	5.175	1.835	-.852	.204	5.533	-17.832	3.805	3.865	.257	-31.432	-.021
3.000	.256	2.954	2.931	5.023	1.863	-.852	.213	4.542	-7.916	3.815	3.865	.257	-31.432	-.020
4.000	.218	2.491	2.831	4.936	1.833	-.852	.213	4.542	-7.916	3.815	3.865	.257	-31.432	-.020
5.000	.196	1.987	2.731	4.844	1.803	-.852	.213	4.542	-7.916	3.815	3.865	.257	-31.432	[illegible]

Table B-33

155mm XM718/XM741 (AV)

OPTION 7?
155MM.XM718/XM741(AV)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.803	2.842	.255	3.634	.198	1.016	9.478	[illegible].000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.095	590.000	5830.000	102.000	20.000	20.000	6.096	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.189	2.787	1.894	4.777	1.112	-.954	-.612	113.006	-1092.556	2.592	4.063	.409	-11.997	-.036
.600	.189	2.787	1.894	4.850	1.150	-.954	-.612	113.006	-1092.556	2.592	4.063	.409	-11.997	-.028
.800	.191	3.312	1.914	4.944	1.030	-.954	-.426	102.694	-989.444	3.187	4.160	.502	-11.997	-.036
.900	.213	3.853	1.945	5.256	.910	-1.070	-.096	74.983	-712.333	3.550	4.184	.589	-14.916	-.041
.950	.255	4.134	2.034	5.118	1.118	-1.360	.224	58.872	-551.222	3.799	4.191	.757	-17.591	-.027
1.000	.260	4.965	2.097	4.875	1.306	-1.244	.345	40.183	-354.333	3.912	4.206	.711	-21.868	-.025
1.050	.299	5.499	2.131	4.456	1.543	-1.128	.444	24.072	-203.222	4.028	4.223	.664	-21.795	-.025
1.100	.298	6.095	2.166	4.467	1.571	-1.070	.464	16.983	-132.333	4.087	4.233	.641	-24.088	-.025
1.200	.285	6.702	2.250	[illegible]	1.623	-.954	.483	11.557	-82.467	4.141	4.257	.594	-26.591	-.025
1.350	.275	6.037	2.440	[illegible]	1.656	-.954	.502	9.894	-61.444	4.160	4.257	.594	-28.799	-.024
1.500	.259	5.567	2.496	[illegible]	1.765	-.954	.511	8.863	-51.133	4.170	4.257	.594	-32.280	-.024
1.750	.234	4.907	2.621	4.732	1.829	-.954	.526	7.812	-40.822	4.179	4.257	.594	-32.280	-.024
2.000	.213	4.262	2.792	4.891	1.866	-.954	.529	6.801	-30.511	4.189	4.257	.594	-32.280	-.023
2.500	.270	3.549	2.914	4.770	1.957	-.954	.535	5.773	-20.200	4.199	4.257	.594	-32.280	-.022
3.000	.233	2.972	2.886	4.579	2.047	-.954	.546	4.739	-9.889	4.209	4.257	.594	-32.280	-.021
4.000	.195	2.467	2.786	4.594	2.017	-.954	.546	4.739	-9.889	4.209	4.257	.594	-32.280	-.021
5.000	.173	1.961	2.686	4.423	1.987	-.954	.546	4.739	-9.889	4.209	4.257	.594	-32.280	-.020

Table B-34

155mm XM692/XM731 (AP)

SPINNER 73
(155MM,XM692/XM731(AP))

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.800	2.842	.255	3.685	.998	1.016	9.478	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.099	540.000	5530.000	103.500	20.000	20.000	6.099	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.189	2.787	1.894	4.874	1.112	-.954	-.661	113.006	-1092.556	2.592	4.063	.360	-10.824	-.038
.600	.189	2.787	1.894	4.837	1.100	-.954	-.651	113.006	-1092.556	2.592	4.063	.360	-10.824	-.039
.800	.191	3.312	1.914	5.032	1.030	-.954	-.475	102.694	-989.444	3.187	4.160	.453	-10.824	-.036
.900	.213	3.853	1.949	5.357	.910	-1.070	-.144	74.583	-712.333	3.550	4.184	.534	-13.768	-.031
.950	.259	4.334	2.034	5.231	1.118	[illegible]	.154	58.872	-551.222	3.799	4.191	.688	-16.448	-.027
1.000	.260	4.905	2.093	4.981	1.306	-1.244	.282	40.183	-364.333	3.912	4.206	.647	-20.731	-.025
1.050	.299	5.499	2.131	4.959	1.543	-1.128	.386	24.072	-203.222	4.028	4.222	.507	-20.665	-.025
1.100	.298	6.099	2.166	4.577	1.571	-1.070	.430	16.583	-132.333	4.087	4.233	.586	-22.969	-.025
1.200	.289	6.702	2.256	4.639	1.627	-.954	.434	11.957	-82.667	4.141	4.257	.546	-25.501	-.025
1.350	.275	6.027	2.440	4.960	1.656	-.954	.453	9.894	-61.444	4.166	4.257	.546	-27.840	-.024
1.500	.259	5.507	2.446	4.752	1.765	-.954	.462	8.863	-51.133	4.170	4.257	.546	-31.557	-.024
1.750	.334	4.907	2.621	4.865	1.829	-.954	.472	7.232	-40.822	4.179	4.257	.546	-31.557	-.024
2.000	.312	4.262	2.792	5.033	1.884	-.954	.481	6.801	-30.511	4.189	4.257	.546	-31.557	-.023
2.500	.270	3.549	2.914	4.915	1.997	-.954	.490	5.770	-20.200	4.199	4.257	.546	-31.557	-.022
3.000	.233	2.972	2.886	4.726	2.047	-.954	.499	4.739	-9.889	4.209	4.257	.546	-31.557	-.021
4.000	.199	2.467	2.766	4.646	2.017	-.954	.499	4.739	-9.889	4.209	4.257	.546	-31.557	-.021
5.000	.173	1.961	2.686	4.560	1.583	-.954	.499	4.739	-9.889	4.209	4.257	.546	-31.557	-.020

Table B-35

155mm XM687 (blk can)

SPINNER 73
155MM,XM687(BLK CANSTR)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.800	2.842	.255	3.611	.094	1.016	9.478	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	SPIN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.095	555.000	5230.000	92.500	20.000	20.000	6.054	59.000	.00238

AERODYNAMIC COEFFICIENTS (WITH COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	C..
.010	-.195	2.787	1.534	4.734	1.112	-.954	-.590	113.006	-1092.555	2.552	4.063	.431	-12.526	[illegible]
.600	.109	2.787	1.654	4.756	1.110	-.954	-.590	113.006	-1092.556	2.552	4.063	.431	-12.526	-.038
.800	.191	3.312	1.914	4.946	1.030	-.954	-.404	102.694	-989.444	3.187	4.160	.524	-12.526	-.036
.900	.213	3.653	1.965	5.253	.910	-1.070	-.065	74.947	-712.333	3.55	4.184	.613	-15.433	-.031
.950	.255	4.334	2.034	5.071	1.114	-1.451	.255	58.872	-551.222	3.755	4.151	.789	-18.106	-.027
1.000	.360	4.905	2.093	4.826	1.305	-1.244	.374	41.183	-364.333	3.51	4.206	.739	-20.381	[illegible]
1.050	.395	5.455	2.131	4.467	1.543	-1.128	.470	24.072	-203.222	4.028	4.223	.650	-22.364	-.025
1.100	.398	6.055	2.166	4.417	1.571	-1.170	.505	16.583	-132.333	4.087	4.233	.656	-24.592	-.025
1.200	.385	6.162	2.251	4.472	1.623	-.954	.505	11.957	-82.167	4.141	4.257	.616	-27.082	-.025
1.350	.375	6.037	2.446	4.770	1.696	-.954	.524	9.694	-61.444	4.16	4.257	.616	-29.232	-.024
1.500	.355	5.547	2.494	4.608	1.765	-.954	.537	8.863	-51.133	4.17	4.257	.616	-32.607	-.024
1.750	.334	4.907	2.621	4.571	1.825	-.954	.542	7.832	-41.822	4.179	4.257	.616	-32.607	-.024
2.000	.312	4.282	2.792	4.615	1.886	-.954	.551	6.801	-30.511	4.189	4.257	.616	-32.607	-.023
2.500	.275	3.549	2.714	4.703	1.997	-.954	.561	5.770	-20.200	-.199	4.257	.616	-32.607	-.022
3.000	.233	2.972	2.888	4.513	2.147	-.954	.57	4.739	-9.889	4.205	4.257	.616	-32.607	-.021
4.000	.195	2.467	2.788	4.440	2.017	-.954	.57	4.739	-9.889	4.205	4.257	.616	-32.607	-.021
5.000	.173	1.761	2.684	4.361	1.987	-.954	.57	4.739	-9.889	4.205	4.257	.616	-32.607	-.020

Table B-36

175mm M437A1, M437A2 (HE)

SPINNER 7?

175MM,M437A1,A2(HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.479	2.930	1.000	3.5?0	.040	1.030	25.021	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
6.865	954.000	11755.000	147.750	20.000	20.000	6.865	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMG	C[illegible]
.010	.098	2.318	1.179	4.356	-.223	-.477	-.345	106.728	-1039.782	3.142	4.130	.615	-11.536	[illegible]
.600	.098	2.318	1.179	4.417	-.247	-.477	-.345	106.728	-1029.782	3.142	4.130	.615	-11.536	[illegible]
.800	.100	2.751	1.199	4.774	-.482	-.477	-.174	98.556	-932.378	3.322	4.219	.703	-11.536	[illegible]
.900	.123	3.315	1.265	5.764	[illegible]	[illegible]	.097	70.810	-670.603	3.585	4.179	.739	-13.307	-.029
.950	.143	3.865	1.310	5.601	-.772	-1.350	.275	55.551	-518.409	3.702	4.072	.775	-15.231	[illegible]
1.000	.241	4.139	1.678	[illegible]	.259	-1.251	.437	37.536	-341.863	3.850	4.128	.782	-18.377	[illegible]
1.050	.325	4.486	1.886	5.16[illegible]	.76[illegible]	-1.141	.577	22.717	-185.869	4.006	4.18	.786	-17.158	-.024
1.100	.323	4.579	1.969	[illegible]	[illegible]	[illegible]	.635	16.020	-122.703	4.088	4.225	.787	-18.353	-.023
1.200	.304	5.474	2.053	4.463	1.129	-.477	.688	11.272	-75.219	4.201	4.309	.790	-19.665	-.022
1.350	.290	4.919	2.249	[illegible]	[illegible]	-.477	.703	[illegible]	[illegible]	4.215	4.309	.790	-18.942	[illegible]
1.500	.273	4.358	2.37[illegible]	4.536	1.366	-.477	.711	8.350	-45.951	4.228	4.309	.790	-19.233	[illegible]
1.750	.245	3.860	2.508	[illegible]	[illegible]	-.477	.72[illegible]	7.376	-36.257	4.237	4.309	.790	-19.233	-.022
2.000	.225	3.370	2.558	3.947	1.58	-.477	.729	6.402	-26.516	[illegible]	4.309	.790	-19.232	-.022
2.500	.203	2.884	2.755	[illegible]	[illegible]	-.477	.73[illegible]	[illegible]	-16.776	4.255	4.309	.790	-19.233	-.021
3.000	.187	2.264	2.718	[illegible]	[illegible]	-.477	.746	4.454	-7.036	4.264	4.309	.790	-19.233	-.020
[illegible]	.152	1.867	[illegible]	[illegible]	[illegible]	-.477	.746	4.454	-7.036	4.264	4.309	.790	-19.233	-.019
[illegible]	.134	1.476	[illegible]	[illegible]	[illegible]	-.477	.746	4.454	-7.036	4.264	4.309	.792	-19.233	-.019

Table B-37

8-Inch M106 (HE)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.39[illegible]	2.573	.5[illegible]	2.[illegible]4	.[illegible]3	1.01[illegible]	8.010	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.9[illegible]	1813.00[illegible]	14504.062	200.000	25.000	25.000	7.99[illegible]	59.000	.00238

AERODYNAMIC COEFFICIENTS (WITH COEFFICIENTS BASED [illegible] ATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CMQ	CYPA	CNPA	CNPA3	PAS	CPF(1)	CPF(5)	CNPA(5)	CMG	C[illegible]
.010	.127	2.399	1.7[illegible]	3.383	.847	-.754	-.46	85.569	-516.387	2.197	3.224	.294	-6.185	-.029
.[illegible]00	.127	2.399	1.702	3.4[illegible]	.824	-.754	-.4[illegible]	85.589	-518.387	2.197	3.224	.294	-6.185	-.029
.800	.129	2.963	1.722	3.668	.739	-.754	-.339	77.770	-740.200	2.384	3.317	.364	-6.125	-.028
.900	.148	3.422	1.778	3.[illegible]	.639	-.[illegible]	-.106	5[illegible].757	-530.073	2.708	3.319	.408	-8.344	-.02[illegible]
.950	.[illegible]	3.786	1.996	4.02[illegible]	.818	-1.[illegible]	.072	44.541	-407.507	2.506	3.287	.481	-10.639	-.020
1.000	.323	4.224	2.132	3.[illegible]31	1.[illegible]37	-.[illegible]	.191	3[illegible].3[illegible]	-26[illegible].153	3.030	3.315	.468	-14.530	-.019
1.050	.396	4.[illegible]	2.2[illegible]	3.556	1.2[illegible]	-.[illegible]	.288	18.153	-144.[illegible]27	3.159	3.347	.455	-13.967	-.019
1.100	.394	5.2[illegible]	2.292	3.[illegible]18	1.[illegible]	-.[illegible]	.32[illegible]	1[illegible].777	-9[illegible].273	3.225	3.366	.448	-15.056	-.0[illegible]9
1.200	.388	5.739	2.366	3.55[illegible]	1.33[illegible]	-.754	.35[illegible]	[illegible].566	-52.157	3.295	3.411	.435	-16.054	-.019
[illegible].300	.372	5.[illegible]66	2.4[illegible]	3.3[illegible]	1.473	-.754	.364	7.4[illegible]	-3[illegible].520	3.317	3.411	.435	-15.367	-.019
1.500	.[illegible]	4.[illegible]	2.[illegible]	3.37[illegible]	1.54[illegible]	-.754	.371	6.520	-2[illegible].761	3.327	3.411	.435	-14.281	-.018
1.750	.334	4.044	2.712	3.16[illegible]	1.[illegible]	-.754	.37[illegible]	5.83[illegible]	-20.483	3.336	3.4[illegible]1	.435	-14.281	-.[illegible]18
2.000	.313	3.51[illegible]	2.756	3.[illegible]	1.728	-.754	.385	5.056	-13.064	3.345	3.411	.435	-14.281	-.018
2.500	.281	2.834	2.9[illegible]	2.[illegible]	1.847	-.754	.39[illegible]	4.275	-5.245	3.355	3.411	.435	-14.281	-.017
3.000	.258	2.348	2.8[illegible]	2.65[illegible]	1.[illegible]97	-.[illegible]	.400	3.4[illegible]3	2.573	3.364	[illegible].411	.435	-14.2[illegible]1	-.016
4.000	.218	1.914	2.7[illegible]	2.651	1.[illegible]	-.754	.40[illegible]	3.493	2.573	3.364	3.411	.435	-14.281	-.016
5.000	.196	1.485	2.[illegible]	2.677	1.835	-.7[illegible]	.400	3.4[illegible]3	2.573	3.364	3.411	.435	-14.281	-.015

Table B-38

8-Inch M426 (chemical)

SPINNER 73

8 IN. M426 (CHEMICAL)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.398	2.273	.503	2.834	.069	1.018	8.010	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.990	1804.000	14430.000	199.000	25.000	25.000	7.990	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.127	2.399	1.702	3.383	.847	-.754	-.480	85.589	-818.387	2.197	3.224	.294	-6.185	-.029
.600	.127	2.399	1.702	3.404	.834	-.754	-.480	85.589	-818.387	2.197	3.224	.294	-6.185	-.029
.800	.129	2.961	1.722	3.604	.739	-.754	-.359	71.710	-740.200	2.384	3.317	.364	-6.185	-.028
.900	.158	3.422	1.778	3.903	.639	-.842	-.106	56.757	-530.073	2.708	3.319	.408	-8.344	-.023
.950	.208	3.780	1.996	4.023	.818	-1.062	.077	44.541	-407.967	2.906	3.287	.481	-10.699	-.020
1.000	.323	4.229	2.132	3.831	1.037	-.974	.191	30.369	-266.193	3.030	3.315	.468	-14.530	-.019
1.050	.396	4.698	2.239	3.556	1.246	-.886	.288	18.153	-144.027	3.159	3.347	.455	-13.967	-.019
1.100	.394	5.225	2.292	3.516	1.300	-.842	.329	12.777	-90.273	3.225	3.366	.448	-15.056	-.019
1.200	.348	5.739	2.366	3.553	1.332	-.754	.350	8.966	-52.157	3.299	3.411	.435	-16.054	-.019
1.350	.372	5.166	2.489	3.389	1.473	-.754	.364	7.402	-36.520	3.317	3.411	.435	-15.367	-.019
1.500	.357	4.594	2.611	3.378	1.549	-.754	.371	6.620	-28.701	3.327	3.411	.435	-14.281	-.018
1.750	.334	4.044	2.712	3.185	1.659	-.754	.378	5.838	-20.883	3.336	3.411	.435	-14.281	-.018
2.000	.313	3.510	2.796	3.093	1.728	-.754	.385	5.056	-13.064	3.345	3.411	.435	-14.281	-.018
2.500	.281	2.834	2.923	2.885	1.847	-.754	.393	4.275	-5.245	3.355	3.411	.435	-14.281	-.017
3.000	.256	2.343	2.880	2.658	1.897	-.754	.400	3.493	2.573	3.364	3.411	.435	-14.281	-.016
4.000	.218	1.916	[illegible]	2.691	1.866	-.754	.400	3.493	2.573	3.364	3.411	.435	-14.281	-.016
5.000	.196	1.485	2.666	2.677	1.835	-.754	.400	3.493	2.573	3.364	3.411	.435	-14.281	-.015

Table B-39

8-Inch M422 (atomic)

SPINNER 7
8 IN.M422(ATOMIC)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BASE DIAMETER	NOSE RADIUS	BOOM LENGTH
4.628	1.525	0.000	3.179	.065	1.012	8.000	.066

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.994	1729.000	11885.000	240.000	25.000	25.000	7.994	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CL-
.010	.215	2.771	2.090	4.466	1.033	-.740	-.530	90.085	-863.364	1.514	3.014	-.115	-1.044	-.021
.600	.215	2.771	2.090	4.467	1.023	-.740	-.530	90.085	-863.364	1.514	3.014	-.115	-1.044	-.021
.800	.217	3.242	2.110	4.573	1.003	-.740	-.782	81.859	-781.089	2.114	3.114	-.041	-1.044	-.025
.900	.265	3.631	2.213	4.713	1.041	-.833	-.546	59.747	-559.973	2.514	3.164	-.005	-4.128	-.025
.950	.326	4.065	2.265	4.8[illegible]	1.053	-1.064	-.379	46.892	-431.418	2.814	3.214	.047	-7.041	-.021
1.000	.440	4.573	2.330	4.873	1.076	-.972	-.249	31.979	-282.293	2.914	3.214	.043	-11.686	-.020
1.050	.515	4.953	2.518	4.955	1.242	-.879	-.137	19.124	-153.738	3.014	3.214	.039	-11.960	-.020
1.100	.514	5.506	2.524	4.923	1.225	-.833	-.088	13.467	-97.173	3.064	3.214	.037	-13.801	-.020
1.200	.514	6.101	2.585	5.003	1.233	-.740	-.056	9.456	-57.064	3.094	3.214	.033	-15.703	-.020
1.350	.495	5.524	2.662	5.043	1.276	-.740	-.041	7.811	-40.609	3.114	3.214	.033	-17.613	-.019
1.500	.475	4.927	2.760	5.065	1.333	-.740	-.034	6.988	-32.381	3.124	3.214	.033	-19.827	-.019
1.750	.446	4.324	2.862	5.018	1.417	-.740	-.027	6.165	-24.154	3.134	3.214	.033	-19.827	-.019
2.000	.419	3.736	2.95[illegible]	4.925	1.499	-.740	-.019	5.343	-15.926	3.144	3.214	.033	-19.827	-.018
2.500	.368	3.178	3.026	4.706	1.517	-.740	-.012	4.520	-7.699	3.154	3.214	.033	-19.827	-.018
3.000	.324	2.683	2.953	4.357	1.599	-.740	-.004	3.697	.529	3.164	3.214	.033	-19.827	-.017
4.000	.286	2.215	2.853	4.295	1.665	-.743	-.004	3.697	.529	3.164	3.214	.033	-19.827	-.016
5.000	.264	1.746	2.753	4.221	1.635	-.740	-.004	3.697	.529	3.164	3.214	.033	-19.827	-.016

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Table B-40

8-Inch M424 (atomic spt)

SPINNER 73
8 IN.M424(ATS SPOTTER)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
4.628	1.575	0.000	3.212	.065	1.018	8.000	.066

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.994	1617.000	11657.000	243.000	25.000	25.000	7.994	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(I)	CPF(S)	CNPA(S)	CMQ	CLP
.010	.215	2.771	2.090	4.554	1.033	-.740	-.961	90.086	-863.364	1.514	3.014	-.147	-.441	[illegible]
.600	.215	2.771	2.090	4.575	1.023	-.740	-.961	90.086	-863.364	1.514	3.014	-.147	-.441	[illegible]
.800	.217	3.242	2.113	4.661	1.003	-.740	-.813	81.659	-781.089	2.114	3.114	-.072	-.441	-.025
.900	.265	3.531	2.213	4.802	1.041	-.833	-.581	59.747	-594.973	2.514	3.164	-.040	-3.547	[illegible]
.950	.326	4.065	2.265	4.899	1.053	-1.064	-.423	44.892	-471.419	2.814	3.214	.002	-6.465	-.021
1.000	.440	4.573	2.330	4.977	1.074	-.972	-.285	31.573	-282.293	2.914	3.214	.002	-11.114	-.020
1.050	.515	4.953	2.518	4.961	1.242	-.879	-.174	19.124	-153.738	3.014	3.214	.002	-11.354	-.020
1.100	.514	5.506	2.534	5.035	1.325	-.833	-.127	13.467	-97.173	3.064	3.214	.002	-13.240	-.020
1.200	.514	6.101	2.585	5.117	1.233	-.741	-.087	9.455	-57.064	3.094	3.214	.002	-15.162	-.020
1.350	.495	5.524	2.662	5.155	1.276	-.740	-.072	7.811	-40.605	.114	3.214	.002	-17.178	-.015
1.500	.475	4.927	2.760	5.185	1.333	-.740	-.065	6.583	-32.381	3.124	3.214	.002	-19.587	-.019
1.750	.446	4.324	2.862	5.138	1.417	-.740	-.054	6.165	-24.154	3.134	3.214	.002	-19.587	-.019
2.000	.419	3.726	2.950	5.053	1.455	-.740	-.050	5.243	-15.426	3.144	3.214	.002	-19.587	-.019
2.500	.368	3.176	3.026	4.828	1.617	-.740	-.043	4.521	-7.659	3.154	3.214	.002	-19.587	-.018
3.000	.324	2.683	2.953	4.481	1.695	-.740	-.035	3.657	.529	3.164	3.214	.002	-19.587	-.017
4.000	.288	2.215	2.853	4.414	1.665	-.740	-.035	3.657	.529	3.164	3.214	.002	-19.587	-.016
5.000	.264	1.746	2.753	4.347	1.635	-.740	-.035	3.697	.529	3.164	3.214	.002	-19.587	-.016

Table B-41

8-Inch M404 (ICM)

[illegible]
8 IN. M404(ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BASE DIAMETER	NOSE RADIUS	ECCY LENGTH
4.4[illegible]	2.41[illegible]	.5[illegible]	2.8[illegible]	.[illegible]6[illegible]	1.01[illegible]	8.010	0.000

DIAMETER INCHES	IX LB-IN**2	IY LB-IN**2	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GIA-ECHO INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.[illegible]50	1745.000	13309.000	200.000	2[illegible].000	25.000	7.990	59.000	.00238

AERODYNAMIC COEFFICIENTS (MATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CNA	CNA	CMA	CNR	CYPB	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.115	2.371	1.664	3.37[illegible]	.815	-.759	-.453	95.228	-918.778	2.252	3.272	.322	-6.276	-.029
.600	.119	2.371	1.6[illegible]	3.35[illegible]	.[illegible]	-.759	-.453	95.628	-918.778	2.252	3.272	.322	-6.276	-.029
.800	.121	2.864	1.664	3.61[illegible]	.7[illegible]4	-.759	-.312	77.606	-740.556	2.437	3.365	.392	-6.276	-.028
.900	.144	3.420	1.735	3.5[illegible]	.5[illegible]	-.[illegible]47	-.[illegible]79	55.783	-530.333	2.755	3.363	.435	-8.376	-.023
.950	.202	3.7[illegible]	1.9[illegible]	3.92[illegible]	.842	-1.[illegible]6[illegible]	.164	44.561	-408.111	2.946	3.32[illegible]	.509	-10.687	-.020
1.000	.32[illegible]	4.21[illegible]	2.111	3.7[illegible]	1.[illegible]5	-.[illegible]7[illegible]	.21[illegible]	3[illegible].3[illegible]3	-266.333	[illegible].071	3.354	.496	-14.450	-.019
1.050	.35[illegible]	4.71[illegible]	2.197	3.4[illegible]	1.[illegible]5[illegible]	-.[illegible]51	.319	1[illegible].161	-144.[illegible]11	3.202	3.390	.482	-13.820	-.019
1.100	.35[illegible]	5.241	2.2[illegible]	3.3[illegible]	1.[illegible]	-.[illegible]7	.3[illegible]	12.783	-9[illegible].333	3.270	3.410	.476	-14.859	-.019
1.200	.3[illegible]	5.[illegible]7[illegible]	2.[illegible]	3.343	1.[illegible]	-.75[illegible]	.37[illegible]	[illegible].[illegible]7[illegible]	-52.200	3.[illegible]45	3.458	.463	-15.810	-.019
1.3[illegible]	.36[illegible]	5.15[illegible]	2.47[illegible]	3.23[illegible]	1.[illegible]	-.759	.39[illegible]	7.[illegible]	-3[illegible].[illegible]	3.365	3.458	.463	-15.062	-.019
1.500	.35[illegible]	4.6[illegible]	2.5[illegible]	3.24[illegible]	1.585	-.759	.399	6.623	-28.733	3.374	3.458	.463	-13.826	-.018
1.750	.33[illegible]	4.144	2.6[illegible]	3.1[illegible]	1.6[illegible]	-.759	.4[illegible]	[illegible].641	-20.911	3.383	3.458	.463	-13.826	-.018
2.000	.3[illegible]	3.93[illegible]	2.7[illegible]	3.[illegible]	1.751	-.759	.43[illegible]	[illegible].059	-13.069	3.392	3.458	.463	-13.826	-.018
2.500	.27[illegible]	2.[illegible]21	2.[illegible]1	3.521	1.[illegible]4	-.759	.42	[illegible].277	-5.267	3.402	3.458	.463	-13.826	-.017
3.000	.2[illegible]	2.33[illegible]	2.[illegible]71	[illegible].143	1.853	-.759	.427	[illegible].494	2.556	3.411	3.458	.463	-13.826	-.016
4.000	.217	1.[illegible]1	2.77[illegible]	[illegible].73[illegible]	1.[illegible]1	-.759	.4[illegible]	[illegible].444	2.556	3.411	3.458	.463	-13.826	-.016
5.000	.19[illegible]	1.471	2.671	[illegible].7[illegible]1	1.8[illegible]5	-.759	.427	3.4[illegible]4	2.556	3.411	3.458	.463	-13.826	-.015

Table B-42

8-Inch M509E1 (ICM)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	C.G.	MEPLAT DIAMETER	DIAMETER	NOSE RADIUS	BOOT LENGTH
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.732	0.000

DIAMETER INCHES	IX	IY	WEIGHT LBS	TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.000	7.99[illegible]	59.000	.002[illegible]

AERODYNAMIC COEFFICIENT ... COEFFICIENTS BASED ON RATE (Q/2V)

MACH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CN A3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMG	C[illegible]
.400	.155	2.658	1.63[illegible]	4.426	1.182	-.913	-.75	107.041	-1032.911	2.777	3.[illegible]	.217	-7.252	-.036
.600	.155	2.65[illegible]	1.6[illegible]	4.44[illegible]	1.310	-.913	-.75	107.041	-1032.911	2.777	3.826	.217	-7.252	-.036
.800	.172	3.1[illegible]	1.[illegible]	4.6[illegible]	1.[illegible]	-.913	-.57[illegible]	97.272	-935.222	2.969	3.932	.305	-7.252	-.035
.900	.197	3.6[illegible]7	1.[illegible]92	4.99[illegible]	.5[illegible]7	-1.[illegible]	-.2[illegible]	71.[illegible]18	-672.6[illegible]3	3.[illegible]	3.948	.358	-10.047	-.029
.950	.253	4.055	1.597	5.225	.[illegible]75	-1.255	-.[illegible]1	55.754	-520.044	3.551	3.940	.444	-1[illegible].652	-.025
1.000	.3[illegible]	4.[illegible]1	2.0[illegible]1	5.[illegible]	1.175	-1.[illegible]	.[illegible]	[illegible]	-342.943	3.[illegible]	3.960	.430	-16.815	-.024
1.050	.3[illegible]5	5.125	2.17[illegible]	4.947	1.327	-1.[illegible]	.20[illegible]	22.744	-190.344	3.785	3.963	.415	-16.626	-.024
1.100	.3[illegible]7	5.[illegible]	2.21[illegible]	4.92[illegible]	1.[illegible]74	-1.[illegible]	.255	1[illegible].0[illegible]	-123.1[illegible]3	3.[illegible]51	3.996	.407	-18.[illegible]39	-.024
1.200	.374	5.27[illegible]	2.255	4.954	1.443	-.913	.2[illegible]7	11.3[illegible]	-75.560	3.513	4.028	.393	-20.845	-.023
1.3[illegible]	.3[illegible]2	5.71[illegible]	2.4[illegible]7	4.9[illegible]	1.[illegible]	-.91[illegible]	.[illegible]	[illegible].352	-56.[illegible]	3.932	4.028	.393	-22.6[illegible]7	-.023
1.500	.34[illegible]	5.16[illegible]	2.541	4.9[illegible]5	1.[illegible]	-.913	.314	[illegible].375	-46.253	3.941	4.028	.393	-25.687	-.0[illegible]
1.750	.321	4.52[illegible]	2.[illegible]	4.[illegible]44	1.772	-.913	.32[illegible]	7.3[illegible]	-36.4[illegible]4	3.951	4.028	.393	-25.687	-.022
2.000	.299	3.92[illegible]	2.7[illegible]	4.7[illegible]	1.[illegible]	-.913	.2[illegible]1	6.422	-26.716	3.961	4.028	.393	-25.687	-.022
2.500	.2[illegible]	[illegible].274	2.91[illegible]	4.597	2.[illegible]	-.913	.34	5.44[illegible]	-16.947	3.97[illegible]	4.028	.393	-25.687	-.021
3.000	.233	2.74[illegible]	2.[illegible]	4.3[illegible]7	2.[illegible]45	-.913	.345	4.468	-7.178	3.980	4.028	.393	-25.687	-.020
4.000	.195	2.27[illegible]	2.7[illegible]	4.317	2.[illegible]35	-.913	.345	4.468	-7.178	3.980	4.028	.393	-25.687	-.019
5.000	.17[illegible]	1.[illegible]	2.665	4.242	2.0[illegible]5	-.913	.345	4.468	-7.178	3.980	4.028	.393	-25.687	-.019

Table B-43

8-Inch XM650E4 (RA, launch)

[illegible]

DIAMETER INCHES	TOTAL LENGTH	IX	NOSE LENGTH	IY	BOAT TAIL LENGTH	WEIGHT LBS	CG (FROM BASE)	GUN TWIST CAL/TURN	[illegible] DIAMETER	ACTUAL TWIST CAL/TURN	[illegible] DIAMETER	[illegible] INCHES	[illegible]	TEMPERATURE DEG-F	BOOM LENGTH	AIR DENSITY SLUGS/FT3
7.950	5.495	1031.000	[illegible]	[illegible]	.451	[illegible]	3.881	20.000	[illegible]	20.000	[illegible]	7.95	[illegible]	59.000	0.000	[illegible]

AERODYNAMIC COEFFICIENTS (THESE COEFFICIENTS BASED ON RATE [illegible])

MACH	CX	CNA	[illegible]	CMA	[illegible]	CYPA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C.G	[illegible]
.010	.145	2.465	[illegible]	[illegible]	[illegible]	[illegible]	-.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
.600	.145	2.465	[illegible]	[illegible]	1.127	[illegible]	-.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
.800	.147	2.465	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.394	[illegible]	[illegible]
.900	.163	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.472	[illegible]	[illegible]	[illegible]	[illegible]
.950	.207	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.534	[illegible]	[illegible]
1.000	.304	[illegible]	[illegible]	[illegible]	[illegible]	-1.158	[illegible]	[illegible]	[illegible]	[illegible]	4.054	.519	-15.325	[illegible]
1.050	[illegible]	[illegible]	[illegible]	[illegible]	1.044	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.124	[illegible]	[illegible]	[illegible]
1.100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.141	[illegible]	[illegible]	[illegible]
1.200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.441	[illegible]	[illegible]
1.350	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.441	[illegible]	[illegible]
1.500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.441	-23.481	[illegible]
1.750	.278	4.173	[illegible]	[illegible]	[illegible]	[illegible]	.411	[illegible]	[illegible]	[illegible]	[illegible]	.441	-23.481	[illegible]
2.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.118	[illegible]	.441	[illegible]	[illegible]
2.500	.228	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.441	[illegible]	[illegible]
3.000	.201	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.437	[illegible]	-7.124	4.135	[illegible]	.441	[illegible]	[illegible]
4.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-7.124	4.135	[illegible]	.441	[illegible]	[illegible]
5.000	.141	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-7.124	4.135	[illegible]	.441	[illegible]	[illegible]

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Table B-44

8-inch XM650E4 (RA, after burn-out)

SPINNER 73
8 IN.XM650E4(RA,AFTER)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.485	3.006	.491	3.600	.069	1.018	20.025	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.990	3849.000	14594.000	187.660	25.000	25.000	7.990	59.000	.00238

AERODYNAMIC COEFFICIENTS (NOTE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPAS	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.145	2.465	1.728	4.248	1.141	-.923	-.604	104.924	-1031.738	2.546	3.992	.362	-7.483	-.036
.600	.145	2.465	1.728	4.273	1.127	-.923	-.604	104.924	-1031.738	2.546	3.992	.362	-7.483	-.026
.800	.147	2.959	1.748	4.506	1.025	-.923	-.428	97.166	-934.156	3.136	4.087	.450	-7.483	-.034
.900	.163	3.455	1.754	5.010	.807	-1.033	-.132	70.940	-671.903	3.472	4.094	.510	-10.115	-.029
.950	.207	3.876	1.822	5.052	.957	-1.308	.109	55.693	-519.431	3.683	4.069	.614	-12.608	-.025
1.000	.304	4.337	2.047	4.812	1.244	-1.198	.246	38.006	-342.563	3.805	4.094	.592	-16.602	-.024
1.050	.352	4.820	2.137	4.491	1.458	-1.188	.362	22.759	-190.051	3.932	4.124	.570	-16.243	-.024
1.100	.344	5.353	2.187	4.441	1.562	-1.033	.411	16.056	-123.003	3.993	4.141	.559	-18.119	-.024
1.200	.337	5.379	2.258	4.371	1.664	-.923	.432	11.293	-75.432	4.058	4.182	.538	-20.181	-.023
1.250	.319	5.326	2.362	4.265	1.793	-.923	.450	9.342	-55.916	4.087	4.183	.538	-21.624	-.023
1.500	.303	4.750	2.477	4.176	1.914	-.923	.459	8.366	-46.157	4.097	4.182	.538	-24.269	-.023
1.750	.272	4.173	2.594	4.042	2.045	-.923	.467	7.396	-36.399	4.106	4.192	.538	-24.269	-.022
2.000	.258	3.602	2.715	3.837	2.187	-.923	.474	6.414	-26.641	4.116	4.182	.538	-24.269	-.022
2.500	.224	2.964	2.847	3.534	2.357	-.923	.485	5.438	-16.883	4.125	4.122	.538	-24.269	-.021
3.000	.201	2.500	2.775	3.325	2.472	-.923	.494	4.462	-7.124	4.135	4.182	.538	-24.269	-.020
4.000	.163	2.068	2.675	3.288	2.371	-.923	.494	4.462	-7.124	4.135	4.182	.538	-24.269	-.019
5.000	.141	1.637	2.575	3.246	2.345	-.923	.494	4.462	-7.124	4.135	4.182	.538	-24.269	-.019

Table E-45

8-Inch XM711 (HE)

MACH	CX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.546	-20.774	[illegible]

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Table B-46

8-Inch XM753 (atomic RA, launch)

SPINNER 73

P 8-IN-XM753(ATM-RA LNCH)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.450	3.003	.453	3.671	.069	1.018	20.025	1.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.993	1930.000	16004.000	200.000	25.000	25.000	7.9[illegible]	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPAS	CNPAS	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.144	2.470	1.726	4.3[illegible]	1.137	-.924	-.665	106.943	-1031.933	2.947	3.993	.297	-5.969	-.036
.600	.144	2.470	1.726	4.358	1.123	-.924	-.665	106.943	-1031.933	2.947	3.993	.297	-5.969	-.036
.800	.147	2.955	1.746	4.627	1.021	-.924	-.494	97.183	-934.333	3.137	4.008	.385	-5.967	-.034
.900	.163	3.460	1.791	5.141	.861	-1.034	-.205	70.553	-672.033	3.472	4.054	.437	-8.634	-.029
.950	.207	3.977	1.924	5.234	.951	-1.308	.016	55.703	-519.533	3.683	4.069	.521	-11.132	-.025
1.000	.304	4.339	2.041	4.963	1.239	-1.158	.161	38.013	-342.623	3.806	4.094	.507	-15.130	-.024
1.050	.352	4.822	2.136	4.650	1.494	-1.088	.285	22.753	-190.133	3.933	4.124	.433	-14.779	-.024
1.100	.345	5.353	2.179	4.6[illegible]2	1.559	-1.034	.338	15.053	-123.[illegible]33	3.998	4.142	.486	-16.665	-.024
1.200	.337	5.879	2.257	4.537	1.661	-.924	.367	11.295	-75.453	4.069	4.183	.473	-18.763	-.023
1.350	.325	5.325	2.362	4.442	1.790	-.924	.385	9.345	-55.933	4.088	4.183	.473	-20.380	-.023
1.500	.303	4.750	2.476	4.356	1.912	-.924	.394	8.367	-46.173	4.097	4.183	.473	-23.347	-.023
1.750	.278	4.174	2.593	4.230	2.043	-.924	.402	7.391	-36.413	4.107	4.183	.473	-23.347	-.022
2.000	.258	3.603	2.715	4.032	2.186	-.924	.411	6.415	-26.653	4.116	4.183	.473	-23.347	-.022
2.500	.224	2.964	2.843	3.738	2.35[illegible]	-.924	.42[illegible]	5.439	-16.893	4.126	4.183	.473	-23.347	-.021
3.000	.201	2.5[illegible]1	2.775	3.524	2.401	-.924	.429	4.463	-7.133	4.135	4.183	.473	-23.347	-.020
4.000	.162	2.665	2.675	3.480	2.370	-.924	.429	4.463	-7.133	4.135	4.183	.473	-23.347	-.019
5.000	.141	1.637	2.575	3.430	2.339	-.924	.429	4.463	-7.133	4.135	4.183	.473	-23.347	-.019

Table B-47

8-Inch XM753 (atomic RA, after burn-out)

SPINNER 73
8 IN.XM753(ATM-RA AFTER)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.450	3.003	.452	3.610	.069	1.018	20.035	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.993	1858.000	15281.000	167.300	25.000	25.000	7.993	59.000	.00238

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.144	2.470	1.726	4.268	1.137	[illegible]	-.613	106.943	-1031.933	2.947	3.993	.353	-7.291	[illegible]
.600	.144	2.470	1.726	4.253	1.123	-.924	-.613	106.943	-1031.933	2.947	3.993	.353	-7.291	-.036
.800	.147	2.955	1.746	4.520	1.021	-.924	-.437	97.183	-934.333	3.137	4.088	.441	-7.291	-.034
.900	.163	3.460	1.791	5.033	.801	-1.034	-.142	70.953	-672.033	3.472	4.054	.500	-9.925	-.029
.950	.207	3.877	1.924	5.117	.951	-1.308	.096	55.703	-519.533	3.683	[illegible]	.603	-13.416	-.025
1.000	.304	4.338	2.041	4.838	1.239	-1.198	.234	38.013	-342.633	3.806	4.054	.580	-16.409	-.024
1.050	.352	4.820	2.136	4.519	1.494	-1.080	.351	22.763	-190.133	3.933	4.124	.560	-16.048	-.024
1.100	.349	5.353	2.179	4.459	1.559	-1.034	.401	16.053	-123.033	3.958	[illegible]	.550	-17.924	-.024
1.200	.337	5.879	2.257	4.399	1.661	-.924	.424	11.295	-75.453	4.069	4.180	.529	-19.989	-.023
1.350	.319	5.320	2.362	4.298	1.790	-.924	.441	9.343	-55.933	4.088	4.123	.529	-21.451	-.023
1.500	.303	4.750	2.474	4.205	1.912	-.924	.450	8.367	-45.173	4.097	4.183	.529	-24.135	-.023
1.750	.278	4.174	2.598	4.071	2.043	-.924	.459	7.391	-36.413	4.107	4.183	.529	-24.135	-.022
2.000	.256	3.603	2.715	3.847	2.186	-.924	.468	6.415	-26.653	4.116	4.183	.529	-24.135	-.023
2.500	.224	2.964	2.843	3.564	2.356	-.924	.476	5.439	-16.893	4.126	4.183	.529	-24.135	-.021
3.000	.204	2.501	2.779	3.354	2.401	-.924	.485	4.463	-7.133	4.135	4.183	.529	-24.135	-.020
4.000	.163	2.065	2.675	3.317	2.370	-.924	.485	4.463	-7.133	4.135	4.183	.529	-24.135	-.019
5.000	.141	1.637	2.575	3.273	2.329	-.924	.485	4.463	-7.133	4.135	4.183	.529	-24.135	-.019

Table B-48

8-Inch XM736 (blk con)

SPINNER 73
8 IN.XM736(BLK CANSTR)

TOTAL LENGTH	NOSE LENGTH	BOAT TAIL LENGTH	CG (FM NOSE)	MEPLAT DIAMETER	BAND DIAMETER	NOSE RADIUS	BOOM LENGTH
5.491	2.465	.024	3.402	.075	1.018	11.732	0.000

DIAMETER INCHES	IX LB-IN-SQ	IY LB-IN-SQ	WEIGHT LBS	GUN TWIST CAL/TURN	ACTUAL TWIST CAL/TURN	GUN-BORE INCHES	TEMPERATURE DEG-F	AIR DENSITY SLUGS/FT**3
7.965	2116.000	17516.000	206.000	25.000	25.000	7.995	59.000	.00239

AERODYNAMIC COEFFICIENTS (RATE COEFFICIENTS BASED ON RATE * (D/2V))

MACH	CX	CX2	CNA	CMA	CPN	CYPA	CNPA	CNPA3	CNPA5	CPF(1)	CPF(5)	CNPA(5)	CMQ	CLP
.010	.207	2.720	2.153	3.645	1.705	-.882	-.675	106.963	-1032.129	2.633	3.728	.288	-10.090	-.034
.600	.207	2.720	2.153	3.067	1.698	-.887	-.675	106.963	-1032.129	2.633	3.728	.288	-10.090	-.036
.800	.205	3.212	2.173	3.763	1.670	-.882	-.503	91.20[illegible]	-934.511	2.832	3.828	.376	-10.090	-.034
.900	.245	3.700	2.201	3.945	1.609	-.952	-.174	70.956	-672.163	3.227	3.874	.469	-13.237	-.025
.950	.301	4.177	2.240	3.950	1.621	-1.266	.145	55.714	-519.636	3.520	3.918	.654	-16.134	-.025
1.000	.387	4.741	2.265	4.033	1.622	-1.156	.254	38.020	-342.703	3.621	3.920	.600	-20.746	-.024
1.050	.413	5.256	2.300	4.127	1.607	-1.047	.337	22.768	-190.176	3.723	3.923	.545	-20.998	-.024
1.100	.410	5.864	2.321	4.?75	1.602	-.952	.370	15.056	-123.063	3.775	3.924	.518	-23.339	-.024
1.200	.398	6.464	2.385	4.246	1.624	-.882	.358	11.297	-75.475	3.808	3.928	.464	-25.821	-.023
1.350	.380	5.873	2.479	4.259	1.684	-.882	.376	9.345	-55.451	3.828	3.928	.464	-28.205	-.023
1.500	.362	5.261	2.594	4.281	1.752	-.882	.384	8.365	-46.189	3.838	3.928	.464	-31.377	-.023
1.750	.334	4.658	2.701	4.233	1.835	-.882	.393	7.395	-36.436	3.848	3.928	.464	-31.377	-.022
2.000	.310	4.053	2.814	4.145	1.927	-.882	.402	6.417	-26.666	3.858	3.928	.464	-31.377	-.022
2.500	.269	3.417	2.920	4.006	2.030	-.882	.411	5.440	-16.904	3.868	3.928	.464	-31.377	-.021
3.000	.236	2.870	2.861	3.862	2.061	-.882	.420	4.464	-7.142	3.878	3.928	.464	-31.377	-.020
4.000	.198	2.384	2.781	3.811	2.031	-.882	.420	4.464	-7.142	3.878	3.928	.464	-31.377	-.019
5.000	.176	1.856	2.681	3.755	2.001	-.882	.420	4.464	-7.142	3.878	3.928	.464	-31.377	-.019

APPENDIX C

CANNON-LAUNCHED GUIDED PROJECTILE AERODYNAMIC DATA

XM712 AD configuration

This summarizes the pertinent data and conclusions pertaining to the aerodynamic characteristics and flight test performance of the Cannon Launched Guided Projectile (CLGP) configuration. The development of the aerodynamic characterization of this configuration is briefly summarized, including both theoretical analyses and wind tunnel and flight test results.

A combination of theoretical analyses, wind tunnel testing and flight testing was utilized to examine the aerodynamic performance capabilities of the CLGP airframe. The aerodynamic properties of the first basic CLGP configuration were obtained by utilizing the Martin-developed CAMS computer program. The CAMS (Computer Aided Missile Synthesis) program aerodynamic module is basically a computerized adaptation and extension of the US Air Force DATCOM Stability and Control Handbook. The CAMS program contains provisions to evaluate both linear and nonlinear contributions to aerodynamic coefficients, including the influence on aft lifting surfaces of vortices generated by forward lifting surfaces, body vortex effects on lifting surfaces, and stall characteristics. Initial CLGP aerodynamics were based on a configuration with a length of 47 inches, corresponding to the alternate proposed configuration.

In order to verify the aerodynamic characterisitics as predicted by the CAMS program, a wind tunnel test was also conducted during the proposal preparation. A 75 percent scale model was constructed of aluminum with high strength steel fins was used. This model included bourrelets and the rear-mounted obturator. The test were conducted in the Ling-Temco Vought 4-foot, high speed wind tunnel facility through a Mach number range of 0.4 to 2.2, with Reynold's numbers of 6.55×10^6 to 7.07×10^6 per foot. The model was mounted on a bent sting that had an angle-of-attack range of from -5 to +30 degrees. The tail fins were manually adjustable with settings at 5-degree increments from -25 to +10 degrees. Data from the wind tunnel test in general substantiated the predicted aerodynamic characteristics as developed by the CAMS program, with the following exceptions. To obtain equivalent trim values of normal force coefficient, the test indicated a required increase in angle of attack of 2 to 3 degrees and approximately a 5-degree increase in fin deflection. Extraction of linear values of normal force, pitching moment and control power from test data at subsonic Mach numbers revealed a reduction from predicted values of 30 to 35 percent. Following the wind tunnel test, aerodynamic coefficient revisions were incorporated in the 6-degree-of-freedom system simulation program in order to bring the aerodynamic data inputs into agreement with the wind tunnel results.

Because the wind tunnel test was conducted on a 75 percent scale model of the 47-inch proposed alternate baseline configuration, it was necessary to apply corrections in order to characterize the 54-inch airframe. These corrections were based upon theoretical modifications to the 47-inch wind tunnel data.

The addition of four strakes to the optical nose cone of the Baseline CLGP produced a new configuration identified as Baseline III. Estimated aerodynamic characteristics of this configuration were obtained by applying theoretical corrections to the baseline aerodynamics in order to account for the four large strakes on the nose.

At the time the Baseline III aerodynamic characteristics were developed, it was recognized that another wind tunnel test would be required in order to verify the predicted coefficients. A series of tests was conducted in May 1972 at both the Ling-Temco-Vought High Speed Wind Tunnel and the Arnold Engineering Development Center Propulsion Wind Tunnel (4T). In general, substantiation of earlier data was obtained, with the exception that the Baseline III configuration with large-size strakes was found, during the LTV test, to be statically unstable at the higher Mach numbers. Therefore, emphasis during the AEDC test was placed on a configuration with a very much reduced strake area which was subsequently to develop into the current Baseline IV configuration. The aerodynamic characteristics of the Baseline IV airframe are given. These data represent the current aerodynamic characterization of the CLGP configuration.

The following four plots (Figures 2 through 5) present out-of-plane aerodynamic coefficients on a body axis system for roll attitudes of 0, 22.5, 45, and 90 degrees. They were derived from the AEDC wind tunnel test data, and are based on 5 degrees of roll command. They are directly applicable to the pitching and yawing moments deriving from vertical fin (numbers 1 and 3) roll deflections. The similar contributions of the horizontal fins (numbers 2 and 4) may be obtained from the four plots as follows:

Use $\phi = 0°$ for $\phi = 90°$

$\phi = 22.5°$ for $\phi = 112.5°$

$\phi = 45°$ for $\phi = 135°$

$\phi = 90°$ for $\phi = 0°$

and switch C_{MP} and C_{MY}

α and β

where C_{MP} is the pitching moment coefficient

C_{MY} is the yawing moment coefficient

α is the pitch angle of attack

β is the yaw angle of attack

With the addition of these out-of-plane coefficients to the aerodynamics, the test flight coning behavior was then predicted.

Examination of flight test results also pointed out a discrepancy between predicted and actual roll rates during ballistic flight. Roll rates were typically 10 to 20 percent lower than predicted. Roll power was subsequently redefined as a function of total fin incident angle rather than the previous fin deflection alone. Fin incident angle is defined as the sum of free-stream or body angle of attack, fin deflection, and body upwash. In the lateral case, it is the sum of body sideslip angle, fin deflection, and body sidewash. Since the CLGP is symmetrical about its X-X axis, angle of attack and body upwash are interchangeable with sideslip angle and body sidewash.

To evaluate body upwash (and sidewash), plots of angle of attack versus pitching moment coefficient were drawn for the body along and for the body plus fins at several fin deflections. At the angle of attack for which the body and the body plus deflected fin pitch moment coefficients are equal, the fin incident angle must be zero. Knowing the angle of attack and fin deflection for each intersection then provides a solution for body upwash as a function of angle of attack and thus the slope of upwash with angle of attack. These solutions were repeated for each of the wind tunnel data Mach numbers to provide the upwash slope variation with Mach number.

With the fin incident angle thus defined, roll power was then generated from the wind tunnel data as a function of this angle for several Mach numbers. These data are shown on Figure 6. Note that total rolling moment coefficient is then defined as:

$$
\begin{aligned}
C_\ell = {} & C_\ell \quad M,\ \delta_1 - \beta \quad 1 + \frac{d\alpha}{d\beta} \\
& + C_\ell \quad M,\ \delta_2 - \alpha \quad 1 + \frac{d\varepsilon}{d\alpha} \\
& + C_\ell \quad M,\ \delta_3 + \beta \quad 1 + \frac{d\alpha}{d\beta} \\
& + C_\ell \quad M,\ \delta_4 + \alpha \quad 1 + \frac{d\varepsilon}{d\alpha}
\end{aligned}
$$

This inclusion of upward (or sidewash) in the aerodynamics then provided a close match with test roll rates.

In summary, the aerodynamics as presented in this report are considered adequate to describe the AD CLGP flight environment as verified by comparison with test flights. The major conclusion to be drawn from this report is that, based upon existing flight test data and analyses, the Baseline IV Final Aerodynamics appear to adequately describe the CLGP airframe aerodynamic characteristics.

The included curves of aerodynamic coefficients are those data recommended for use in flight simulations of the CLGP projectile. Stability and control, axial force, roll characteristics, and damping derivatives have been given for projectile roll attitudes of 0 and 45 degrees.

The data curves given were based on wind tunnel data measured on a 75 percent scale model tested during May 1972. Figure 7 presents the axis system and sign convention. Reference area and length for all coefficients were 0.196 ft^2 and 0.5 ft, respectively. The collected aerodynamic coefficients are plotted in Figures 8-34.

Figure 1 in the report from which this Appendix C is excerpted was not needed.

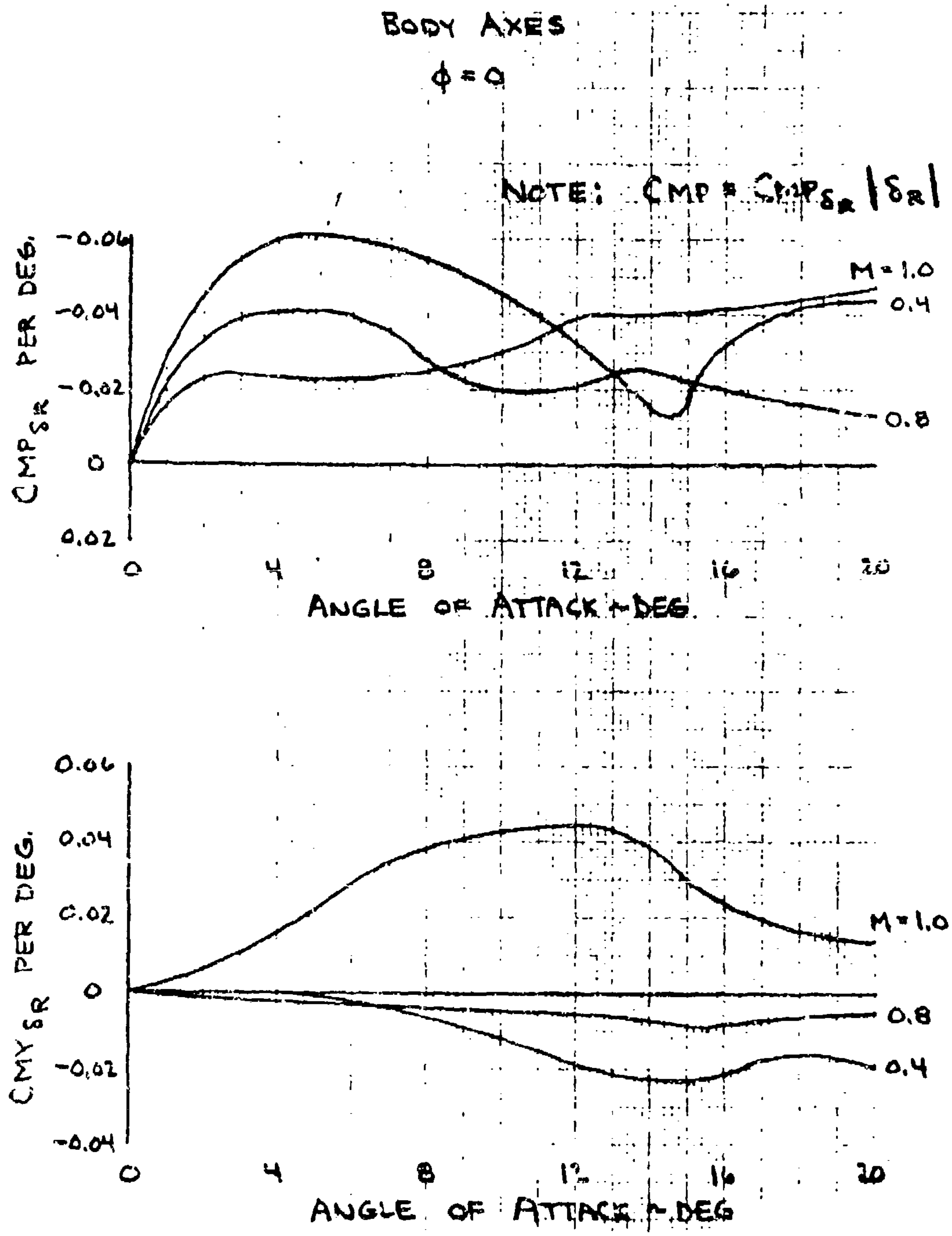


Fig 2. Pitching moment and yawing moment due to roll command

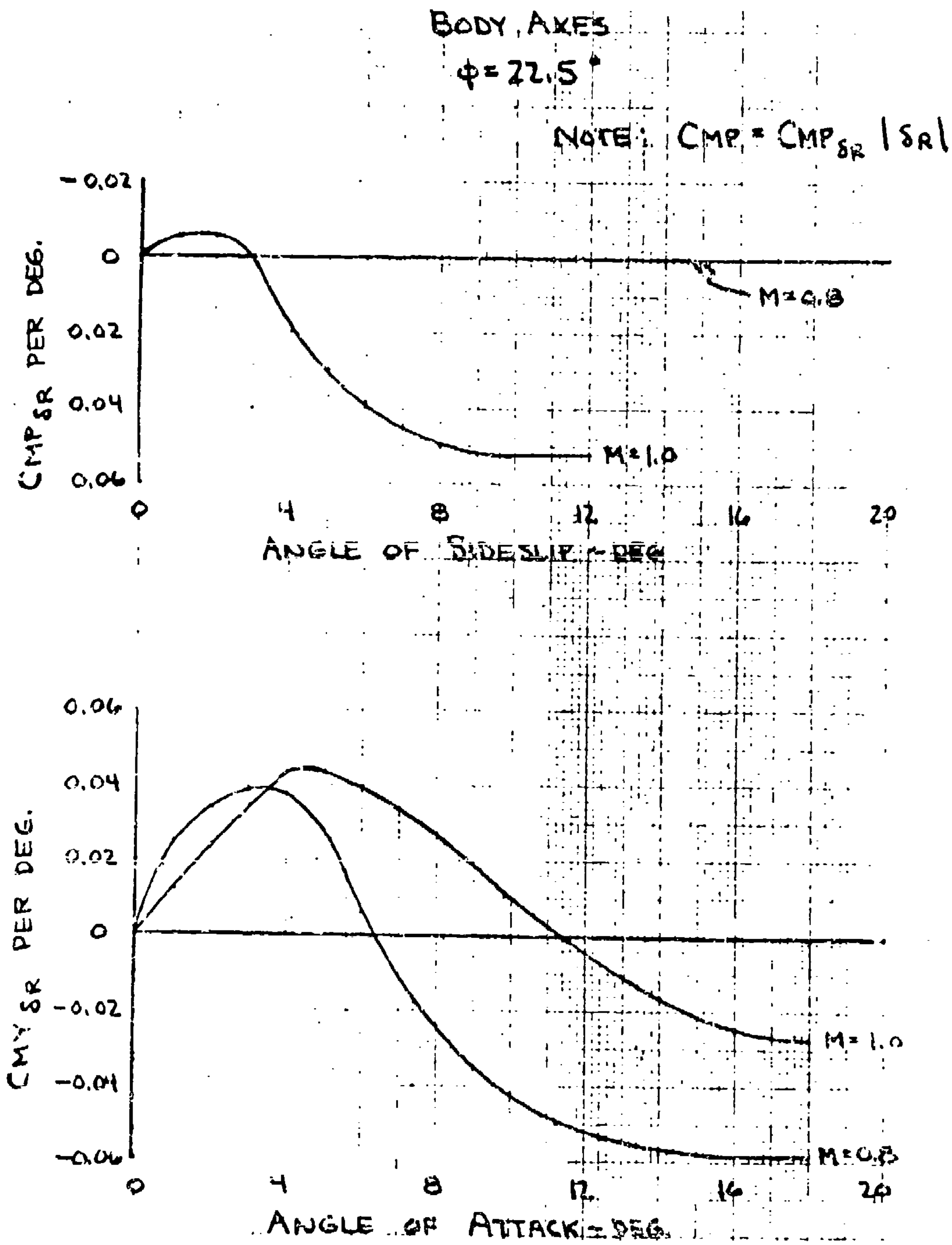


Fig 3. Pitching moment and yawing moment due to roll command

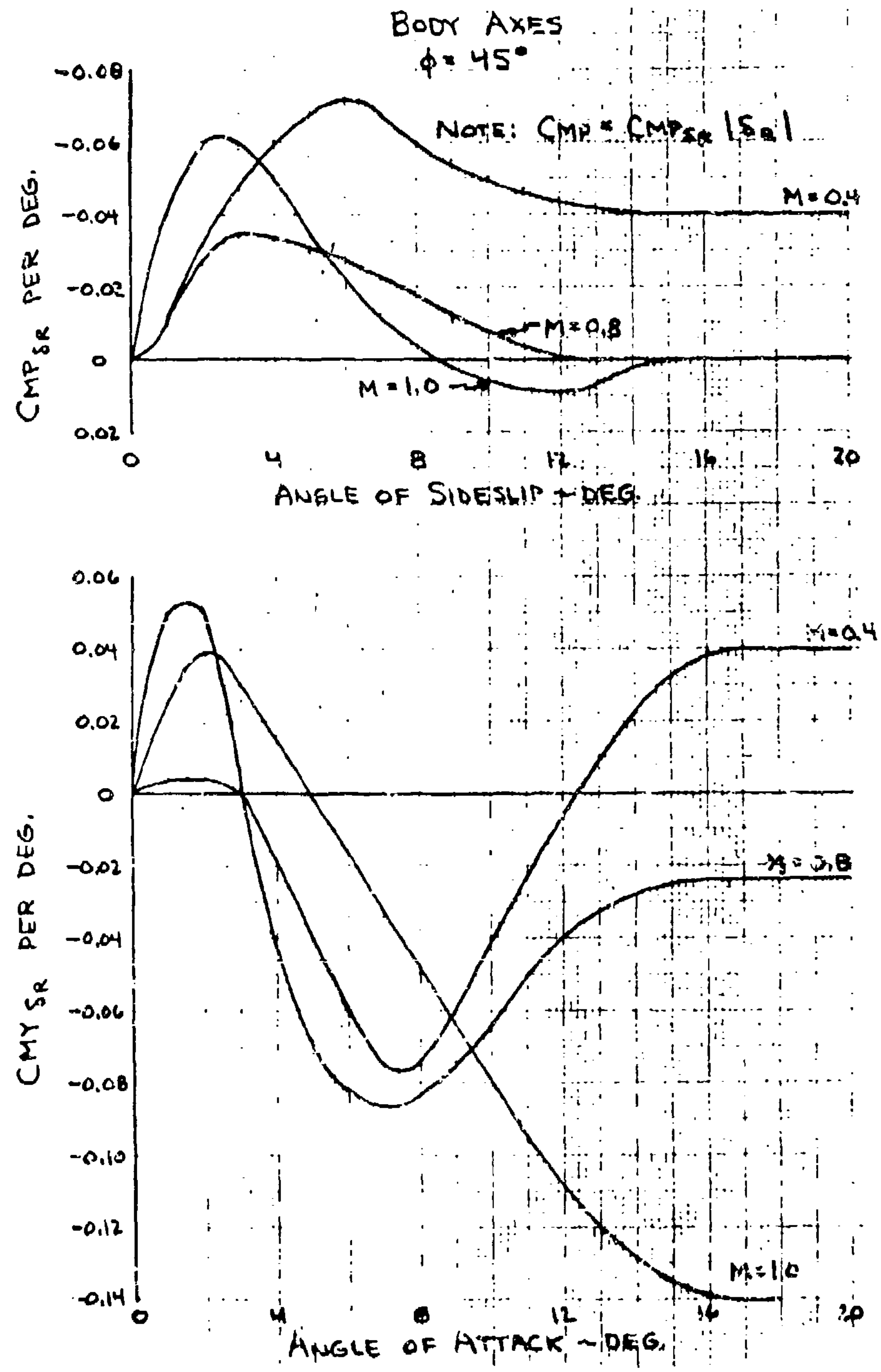


Fig 4. Pitching moment and yawing moment due to roll command

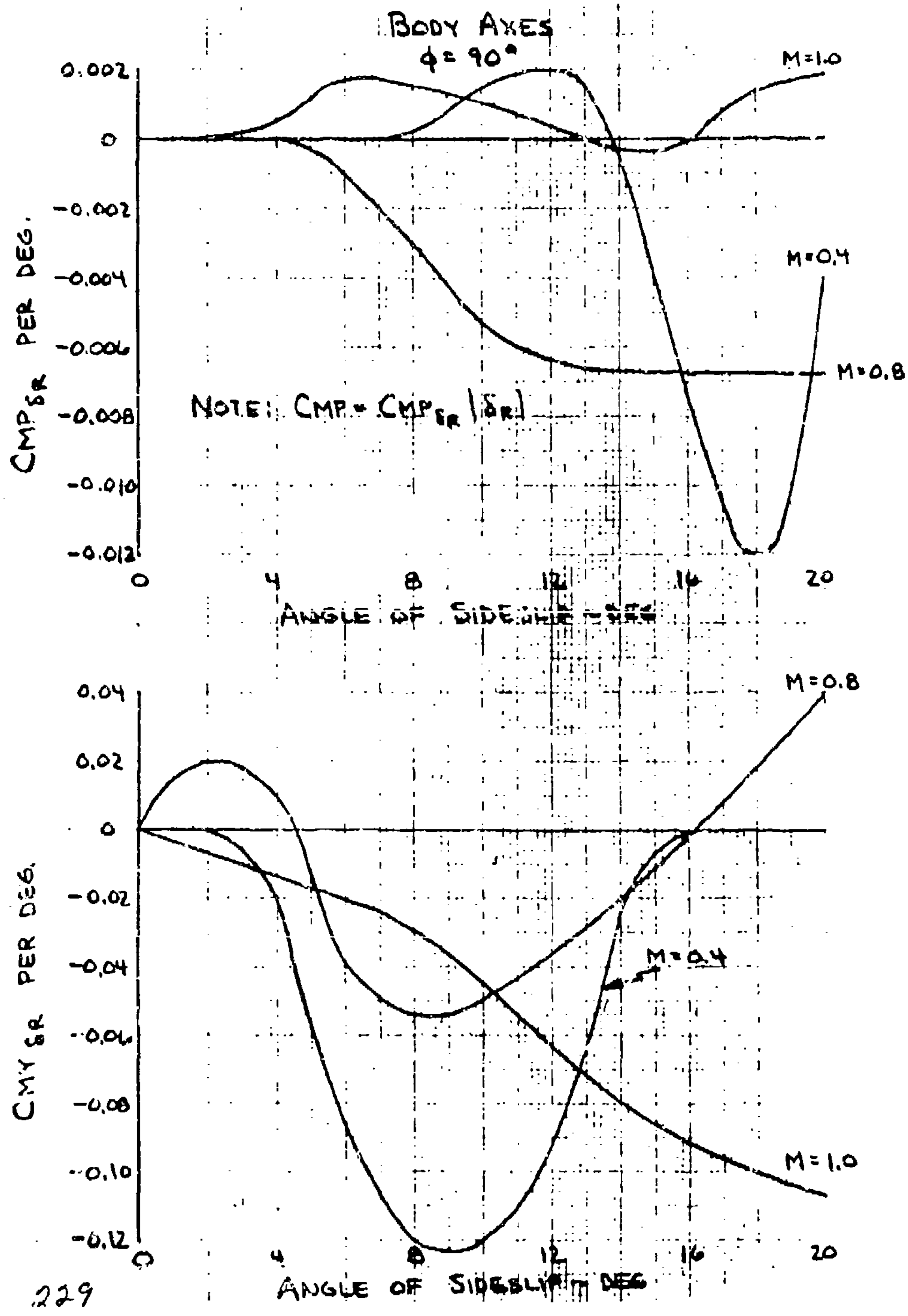


Fig 5. Pitching moment and yawing moment due to roll command

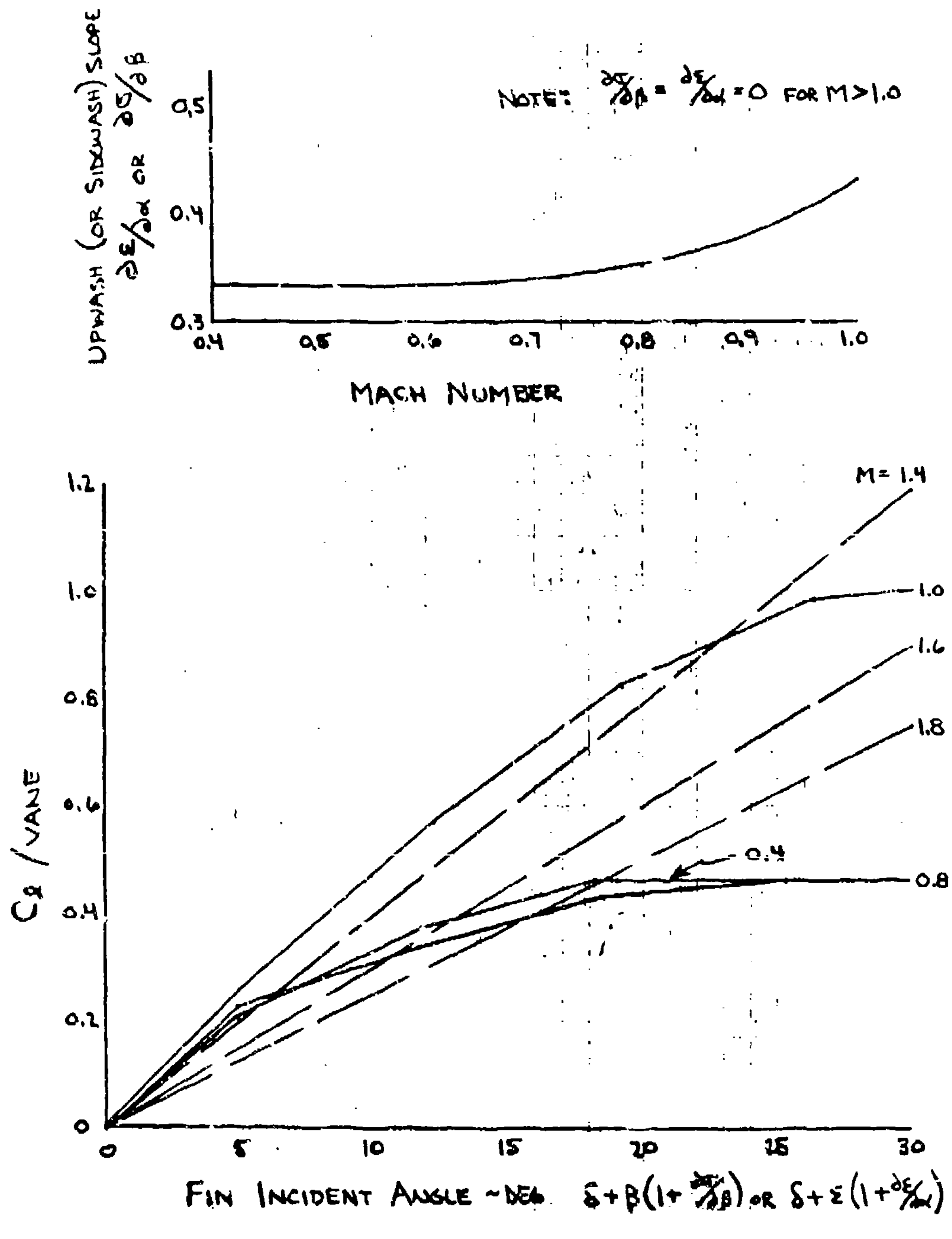


Fig 6. Roll power

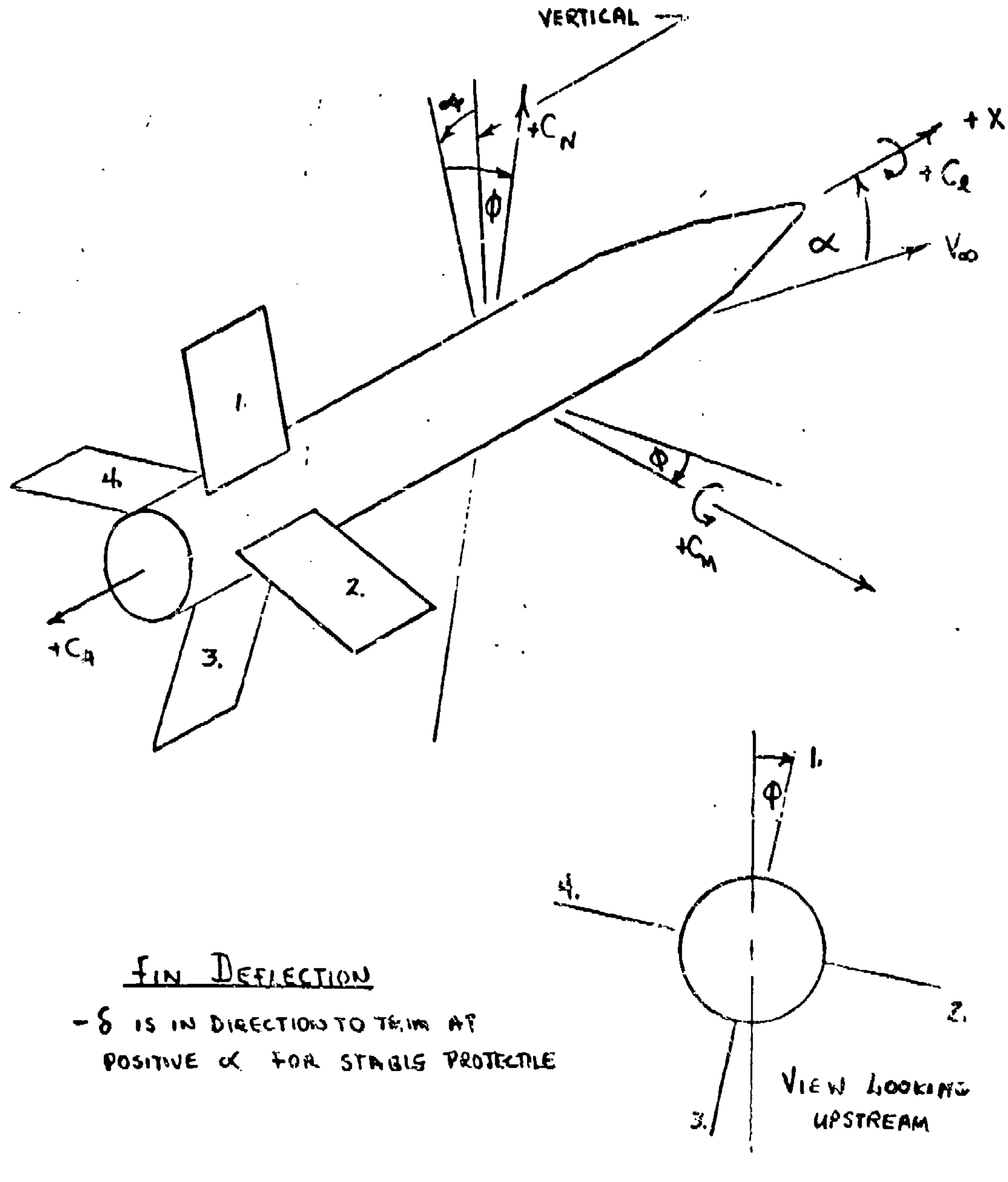


Fig 7. Axis system and sign convention

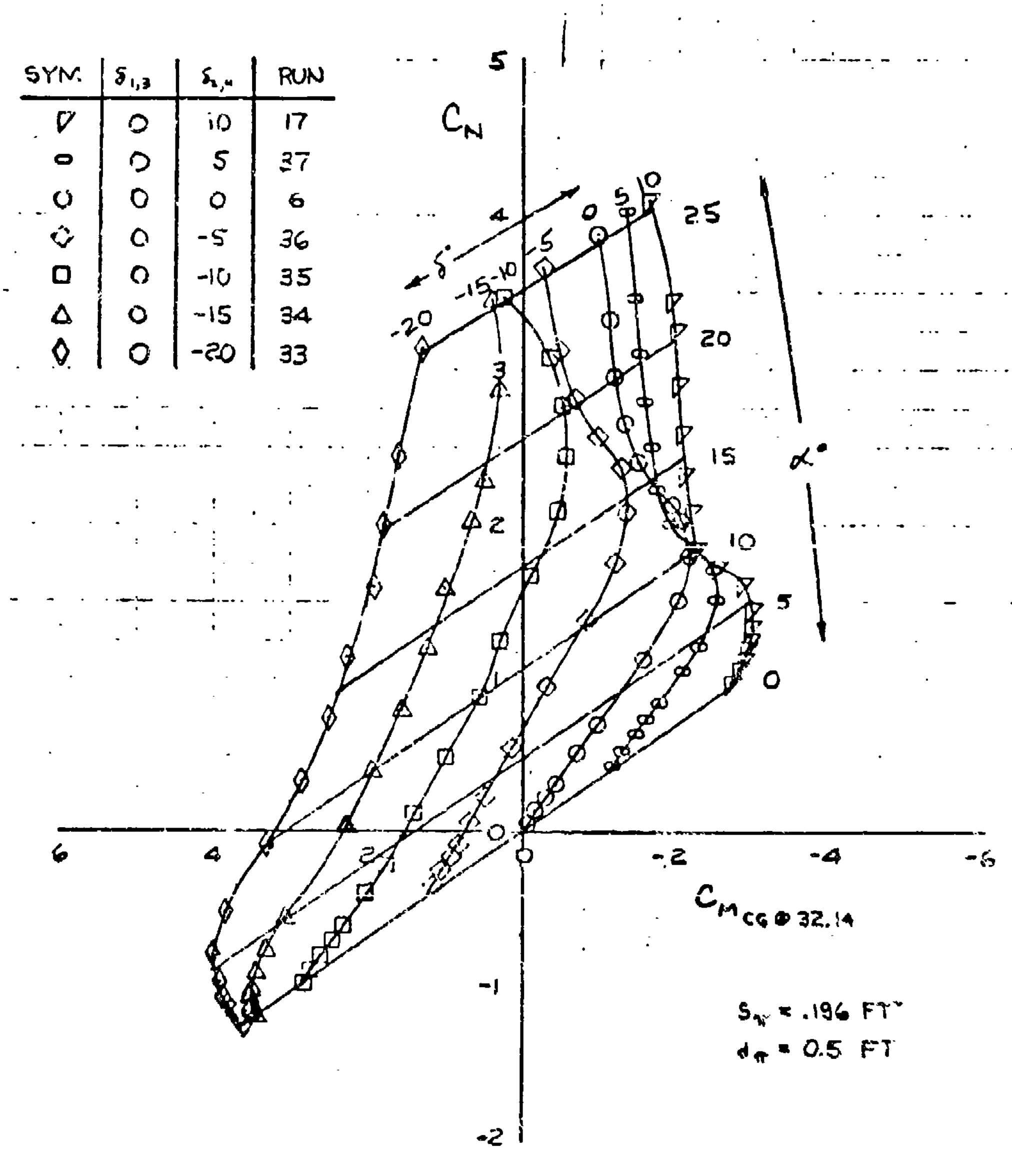


Fig 8. Lon._ tudinal stability, M = 0.4, $\phi = 0°$

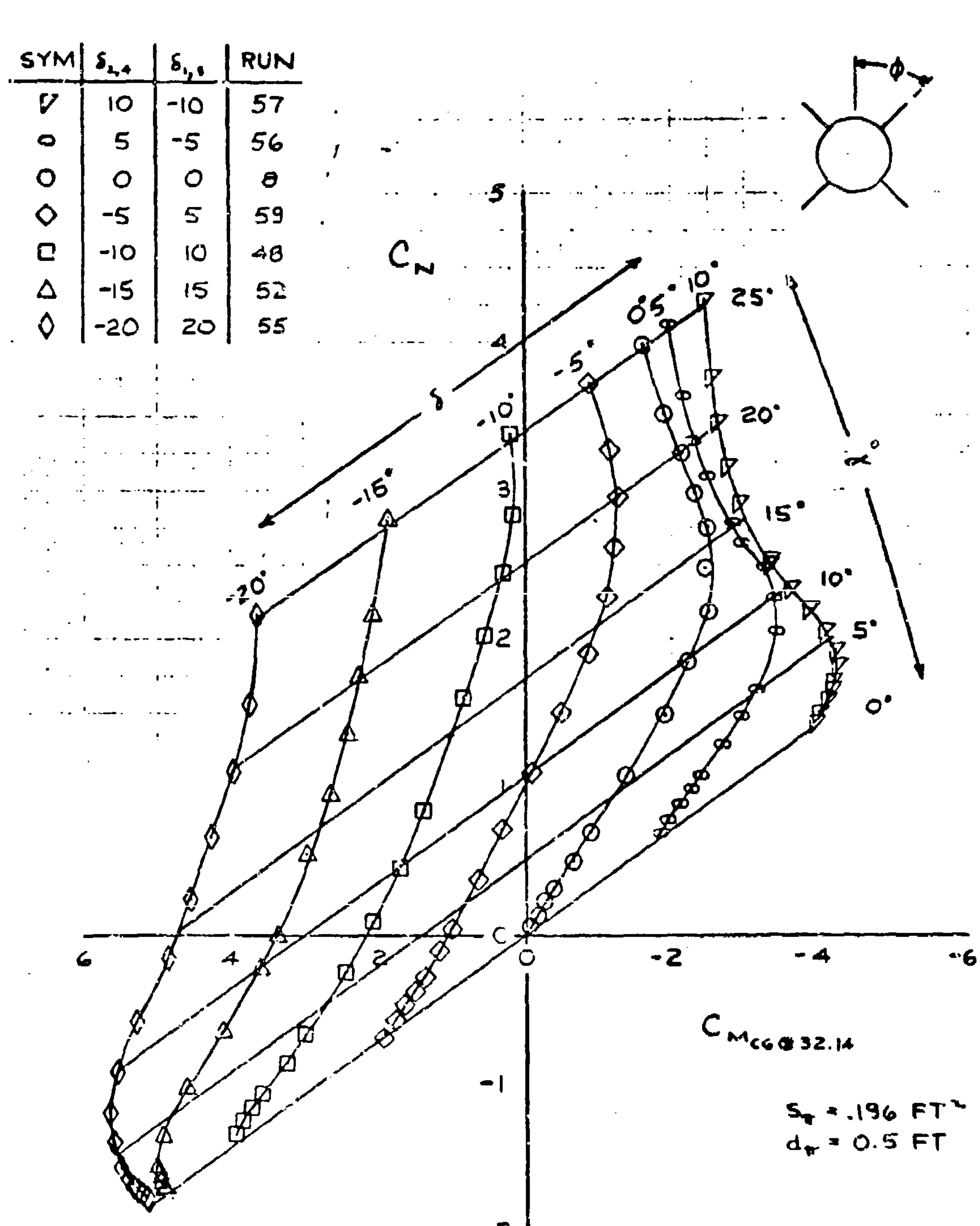


Fig 9. Longitudinal stability, M = 0.4, ϕ = 45°

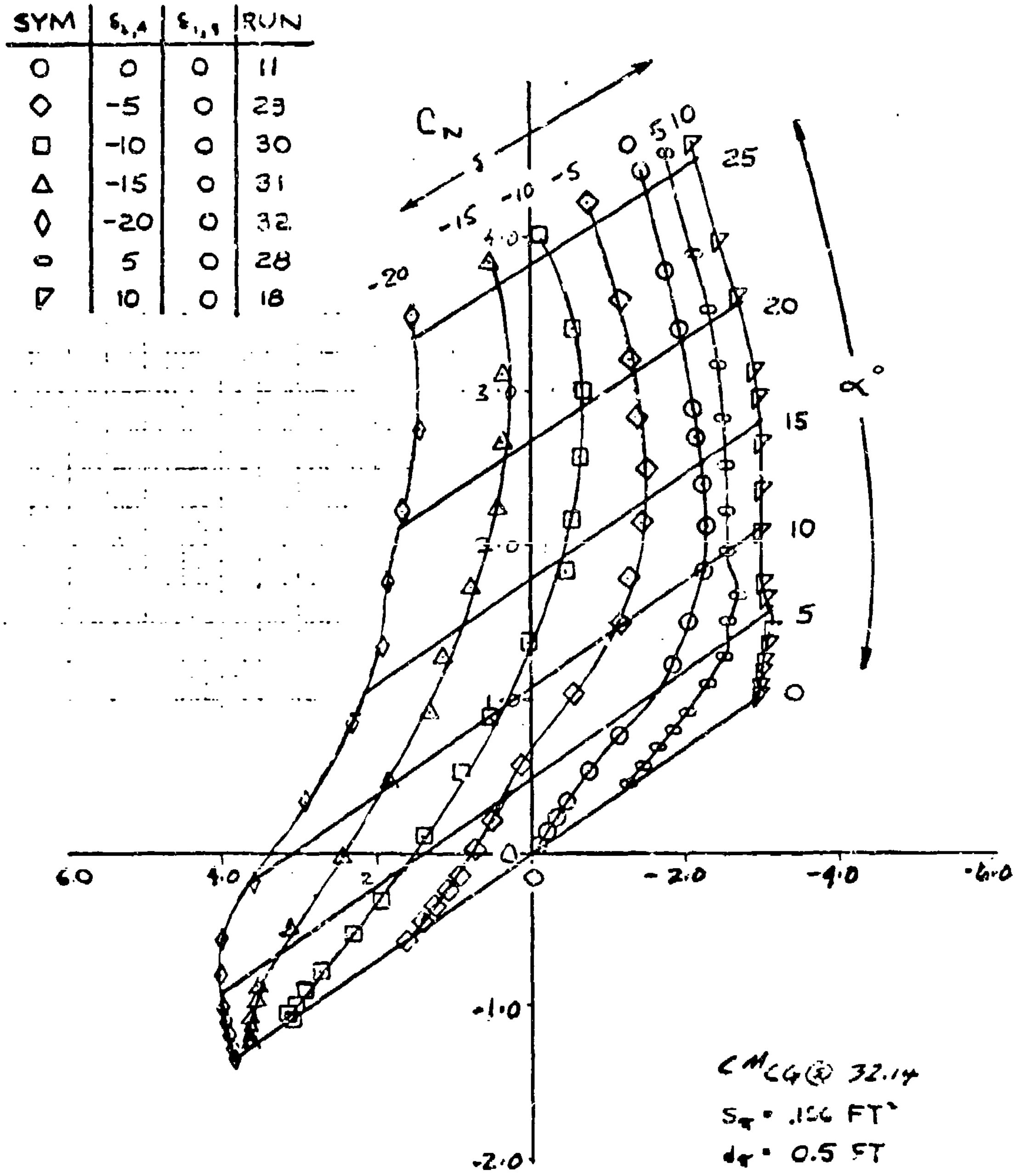


Fig 10. Longitudinal stability, M = 0.8, ϕ = 0°

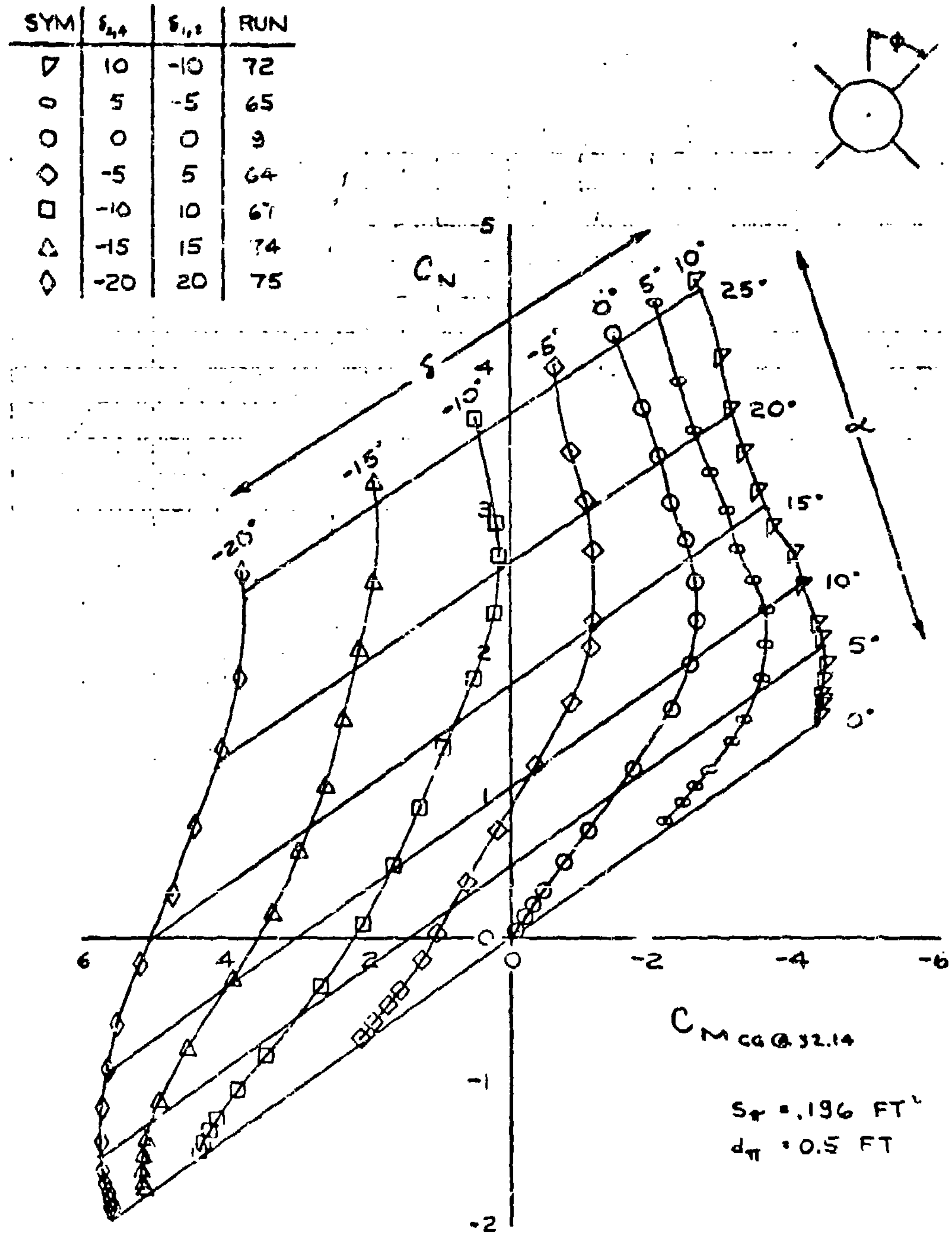


Fig 11. Longitudinal stability, M = 0.8, ϕ = 45°

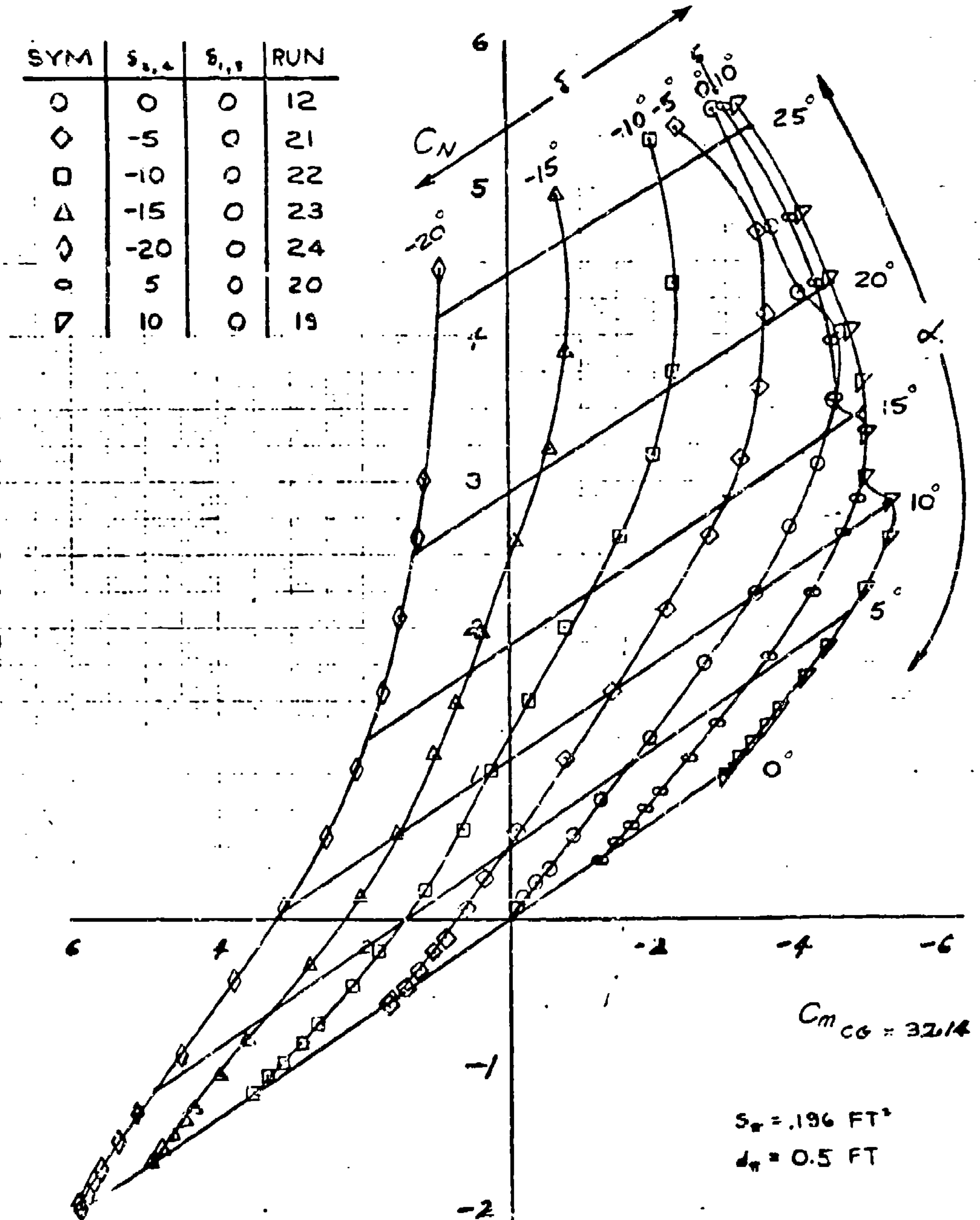
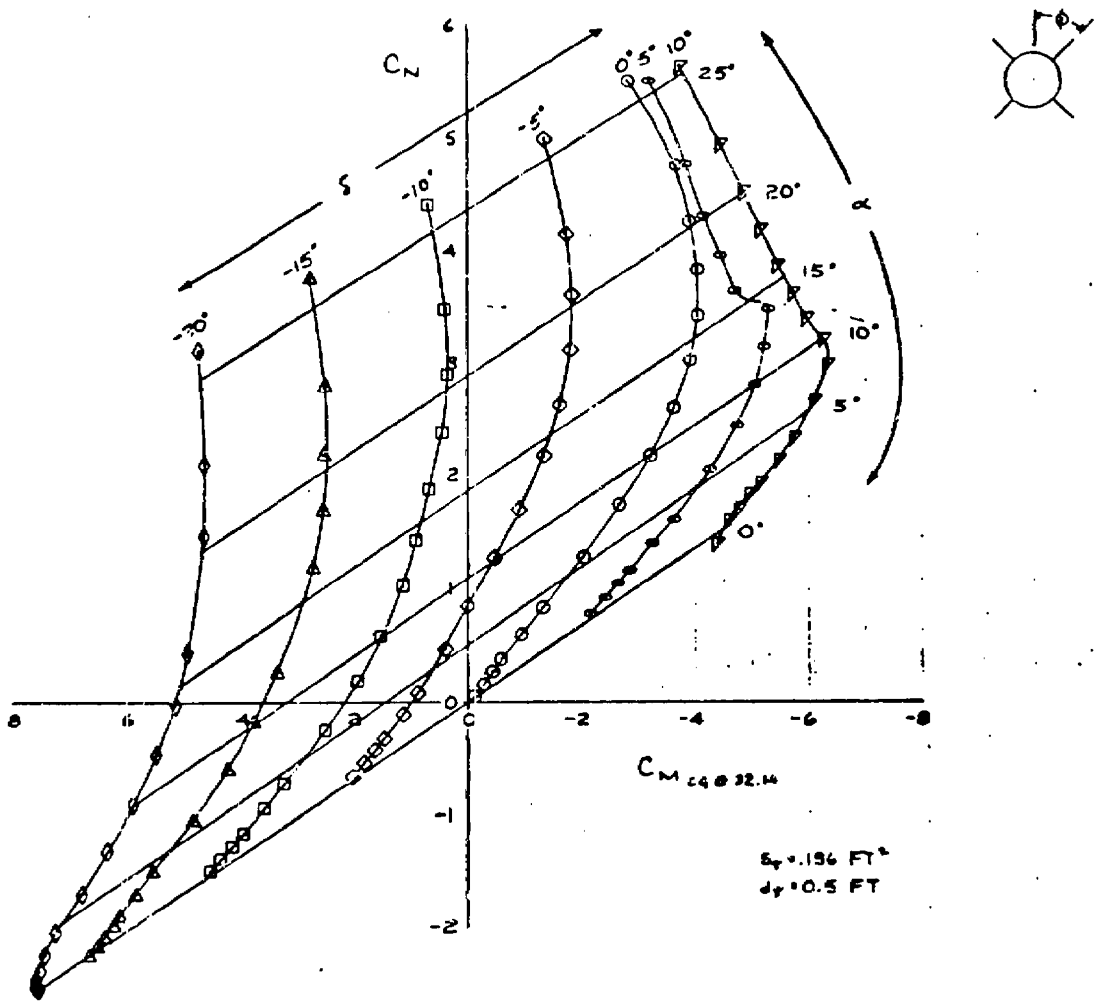


Fig 12. Longitudinal stability, M = 1.0, ϕ = 0°



SYM	$\delta_{2,4}$	$\delta_{1,3}$	RUN
▽	10	-10	55
○ (small)	5	-5	82
○	0	0	14
◇	-5	5	81
□	-10	10	84
△	-15	15	91
◊	-20	20	52

Fig 13. Longitudinal stability, M = 1.0, $\phi = 45°$

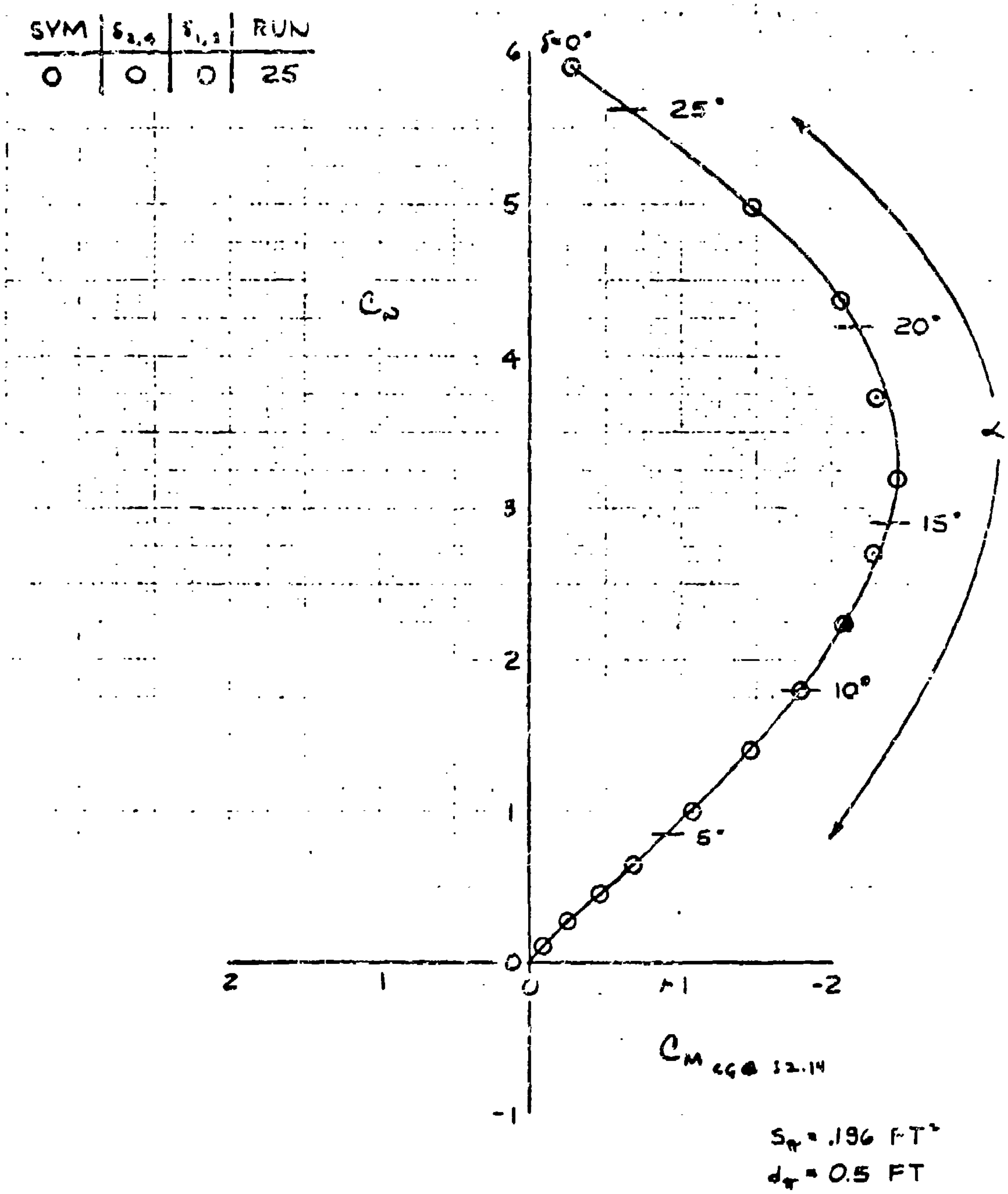


Fig 14. Longitudinal stability, $M = 1.3$, $\phi = 0°$

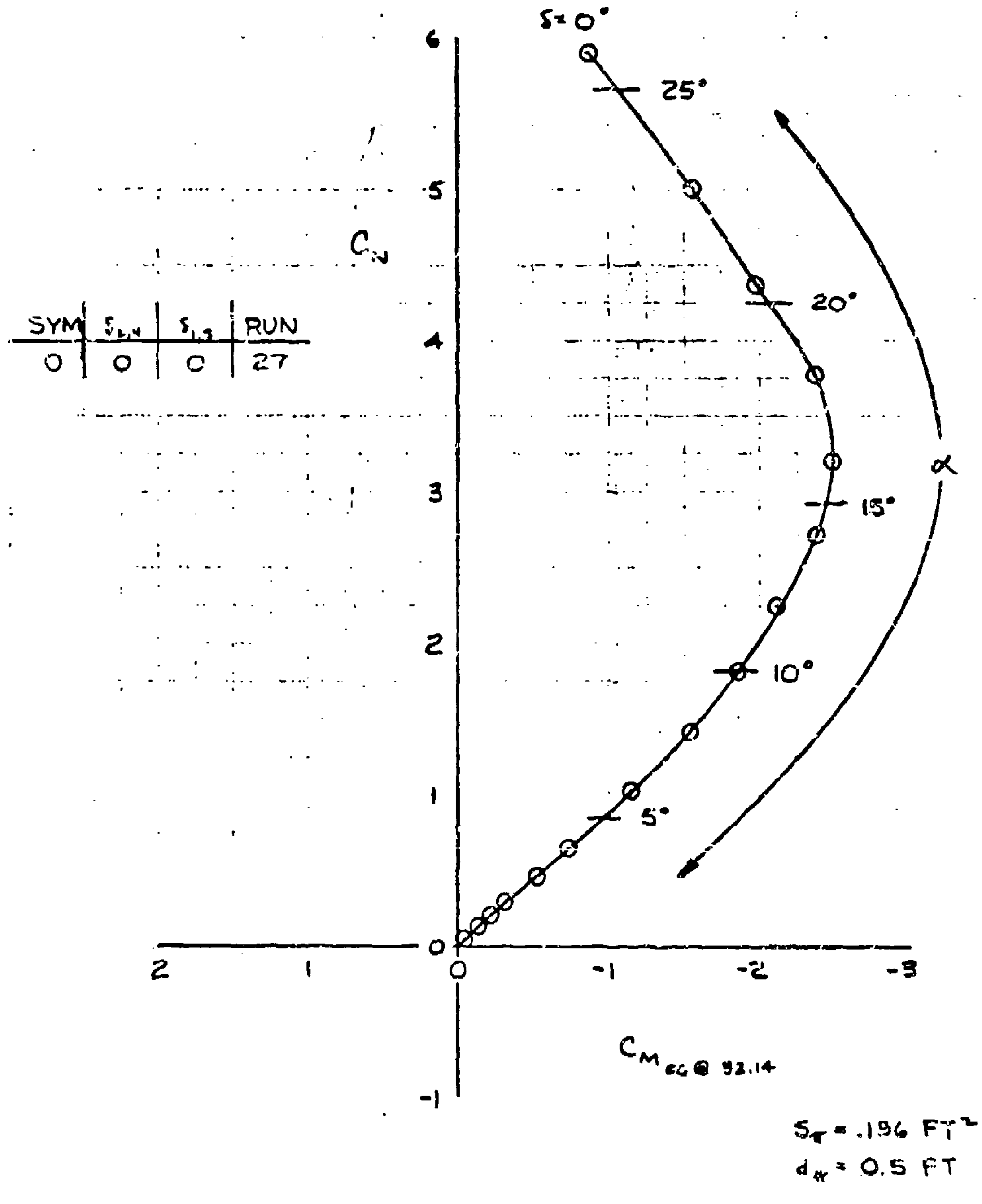


Fig 15. Longitudinal stability, M = 1.3, $\phi = 45°$

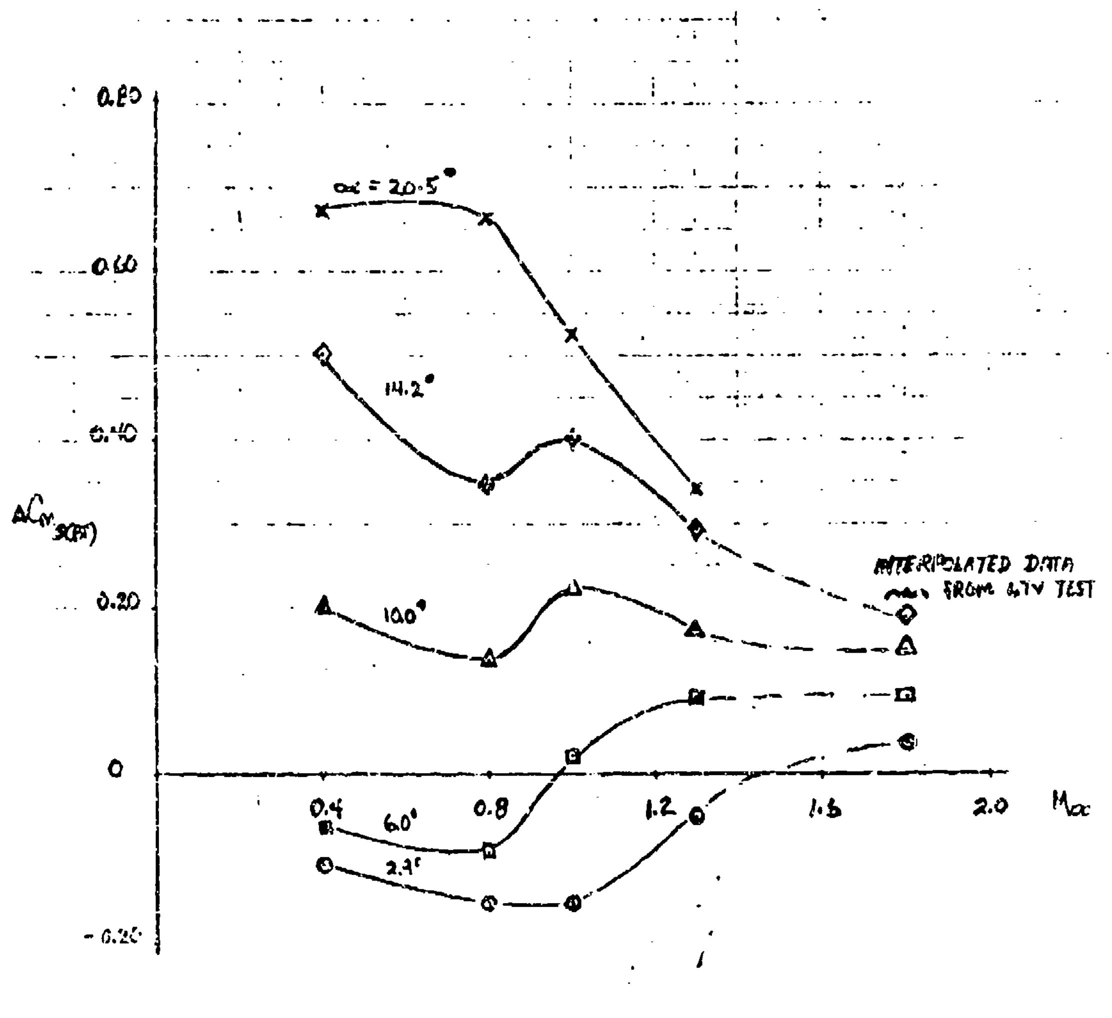


Fig 16. Pitching moment due to strake S_{δ}, $\varphi = 0°$

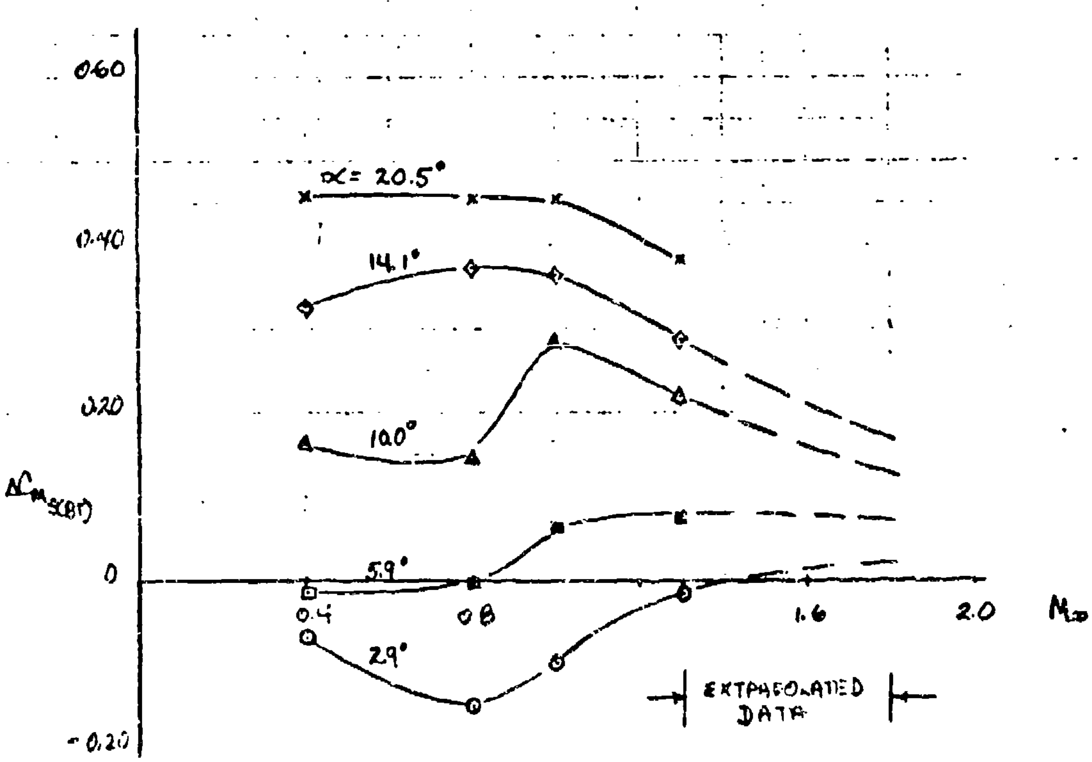


Fig 17. Pitching moment due to strake S_5, $\phi = 45°$

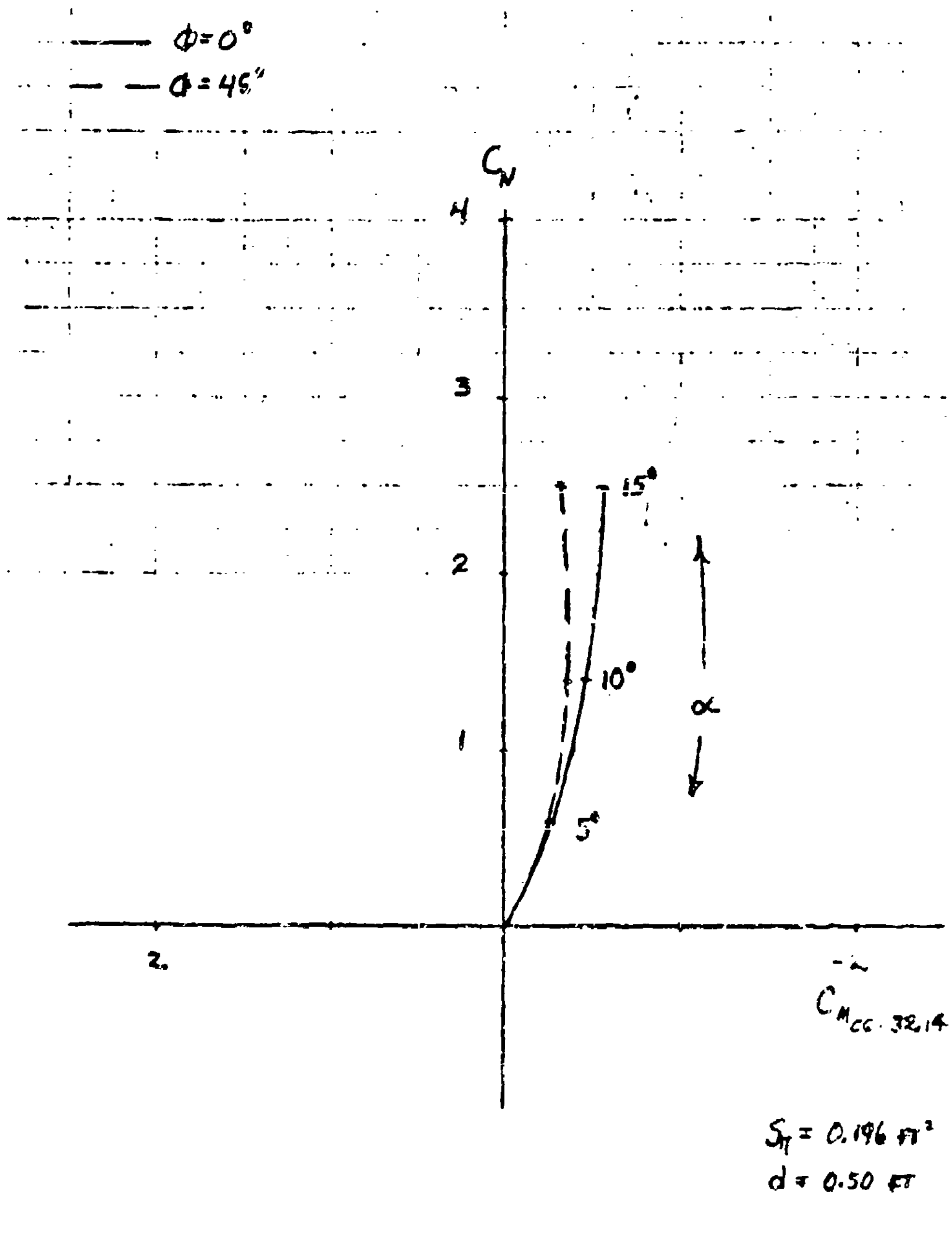


Fig 18. Longitudinal stability, M = 1.8

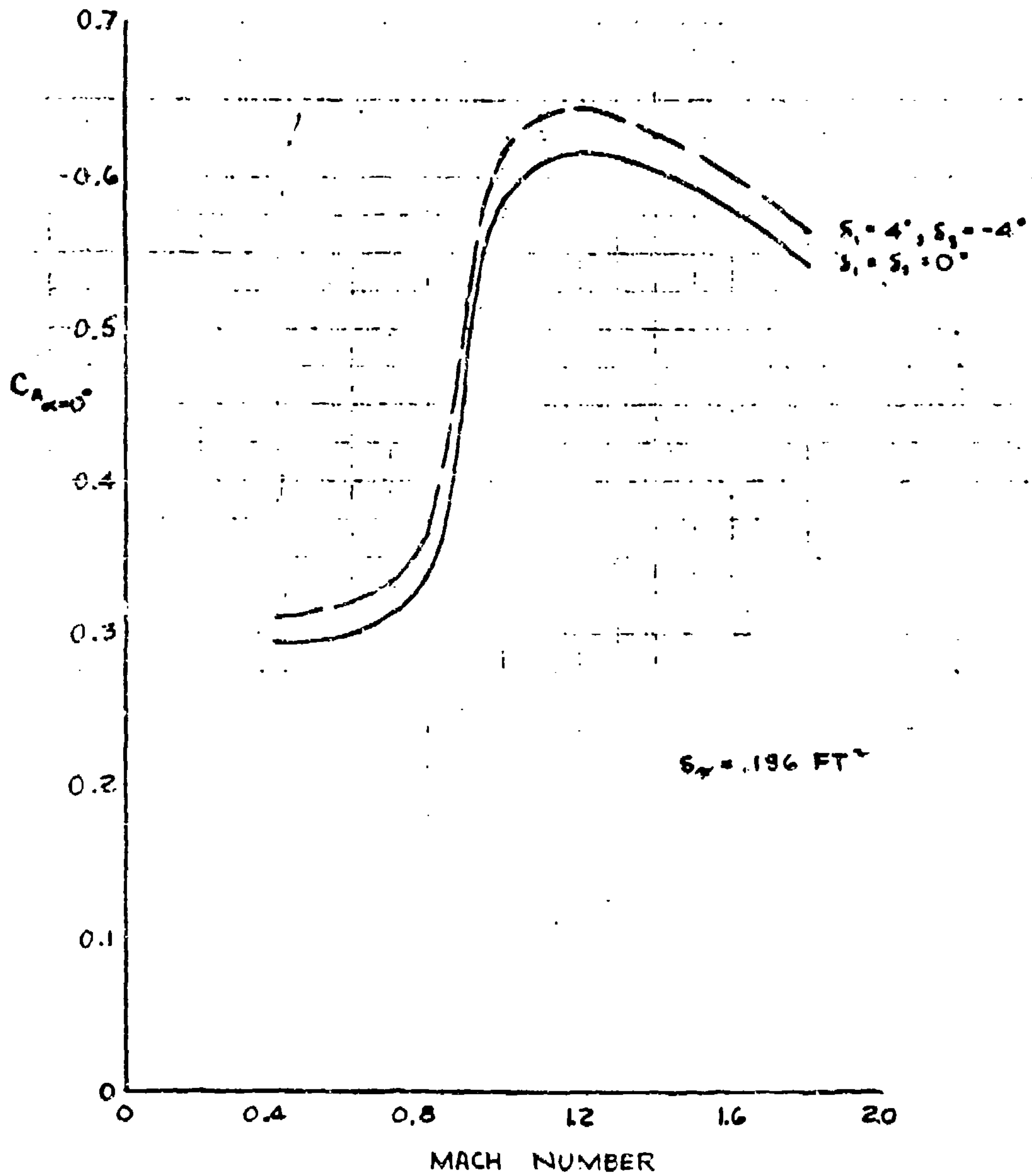


Fig 19. Axial Force, $\phi = 0°$ & $45°$, $\alpha = 0°$, $\delta_{2,4} = 0°$, altitude = 4000 ft

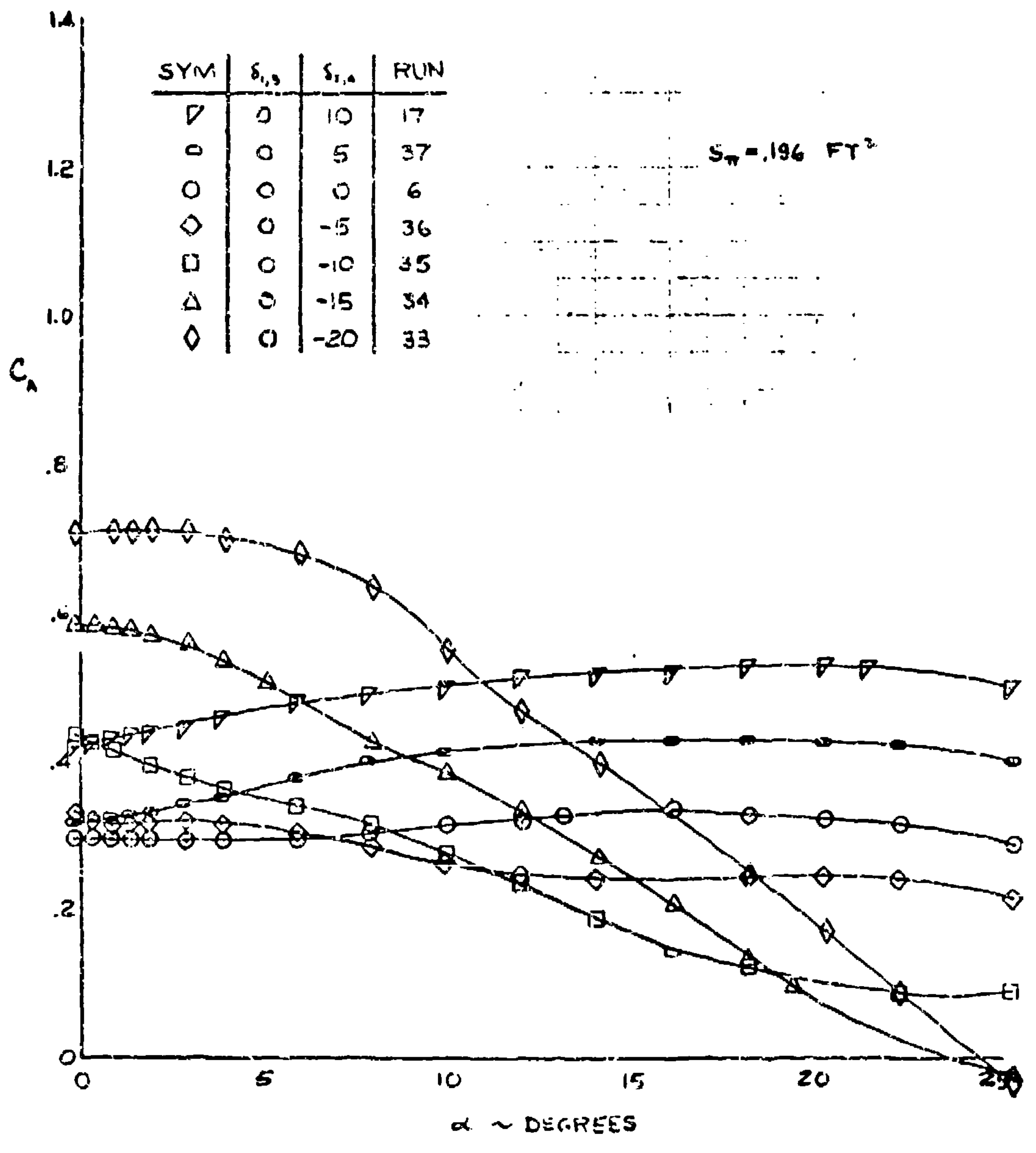


Fig 20. Axial Force M = 0.4, φ = 0°, altitude = 4000 ft

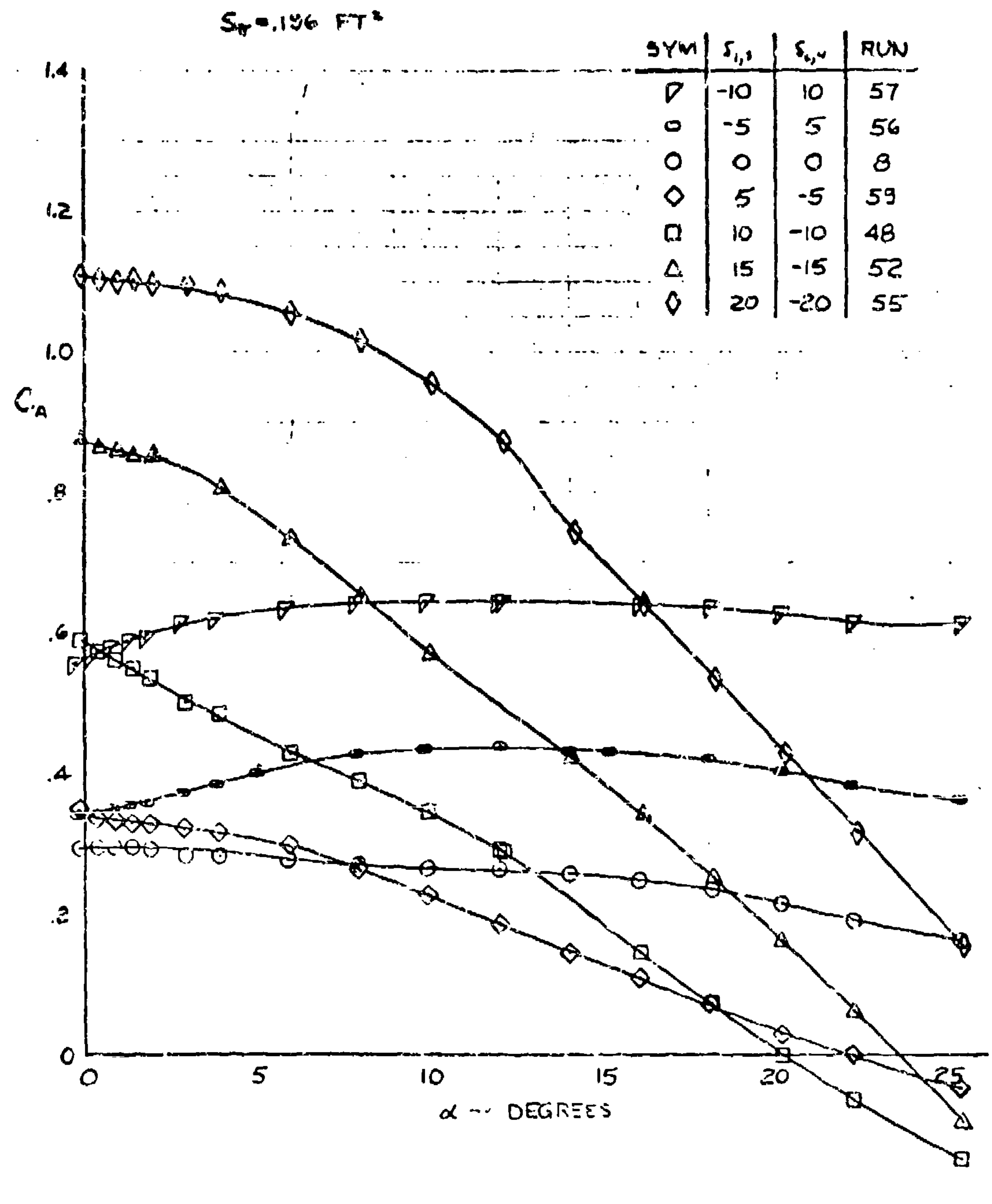


Fig 21. Axial Force M = 0.4, ϕ = 45°, altitude = 4000 ft

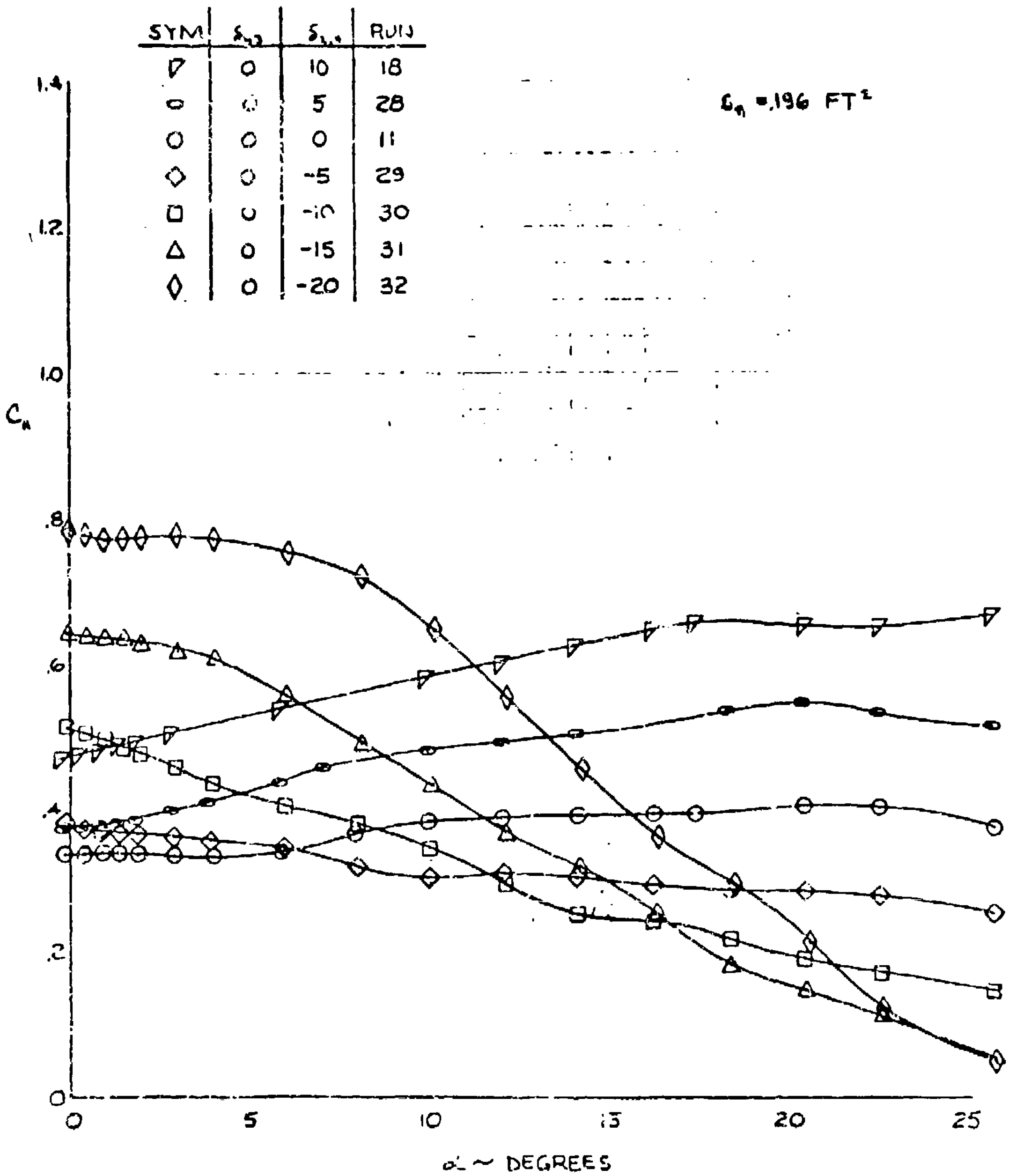


Fig 22 Axial force M = 0.8, ϕ = 0° altitude = 4000 ft

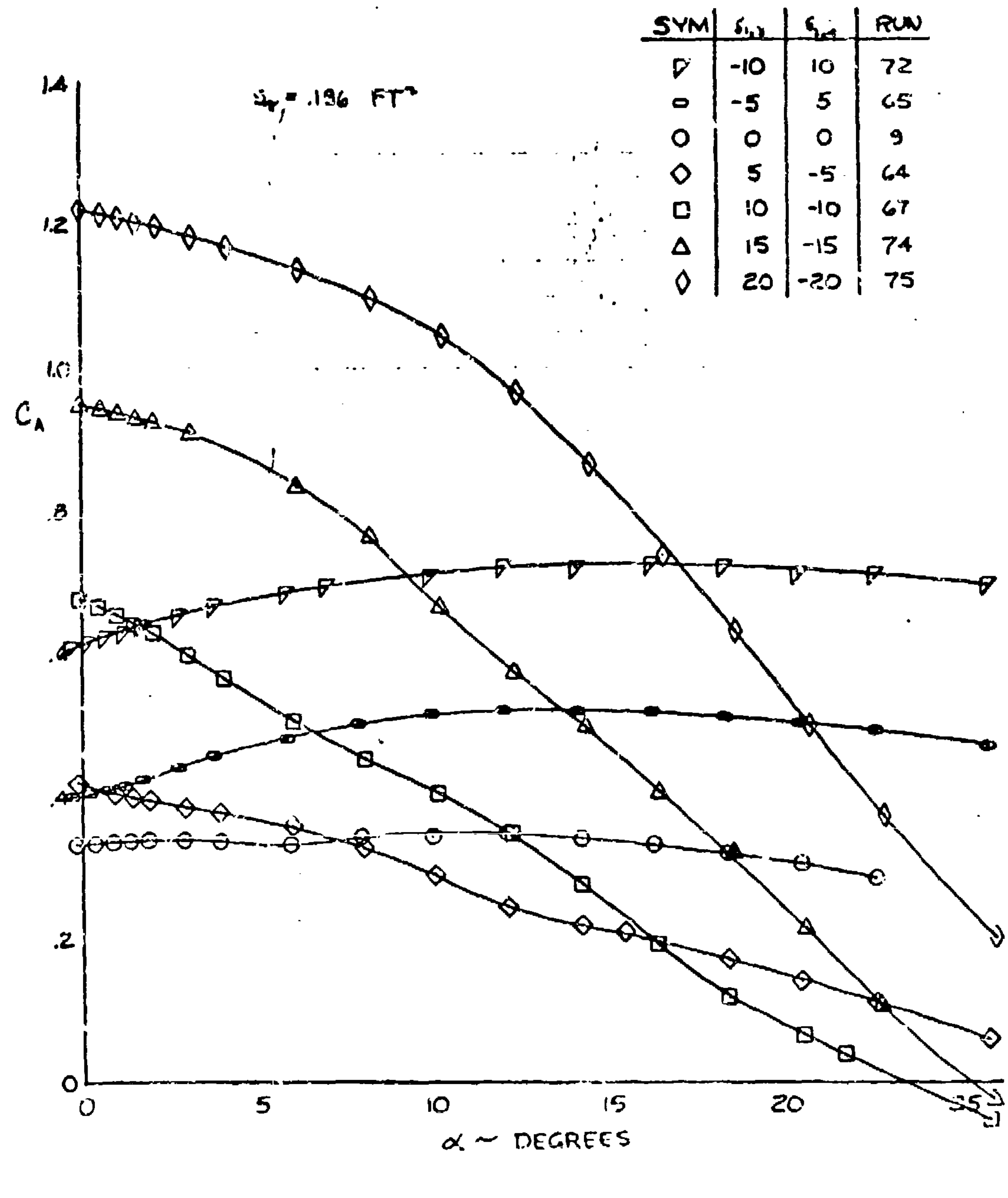


Fig 23. Axial force M = 0.8, ϕ = 45°, altitude = 4000 ft

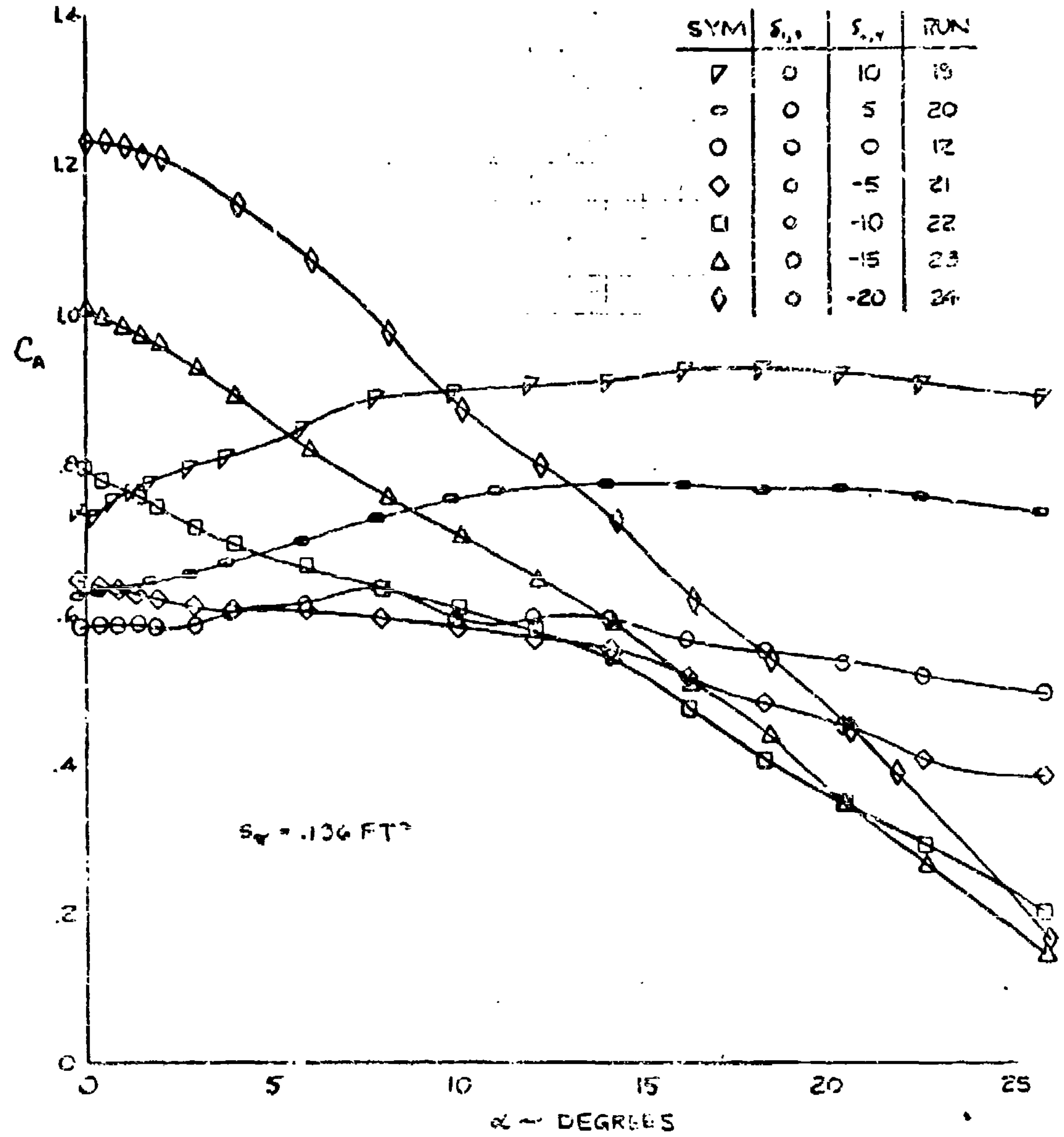


Fig 24. Axial force M = 1.0, φ = 0°, altitude = 4000 ft

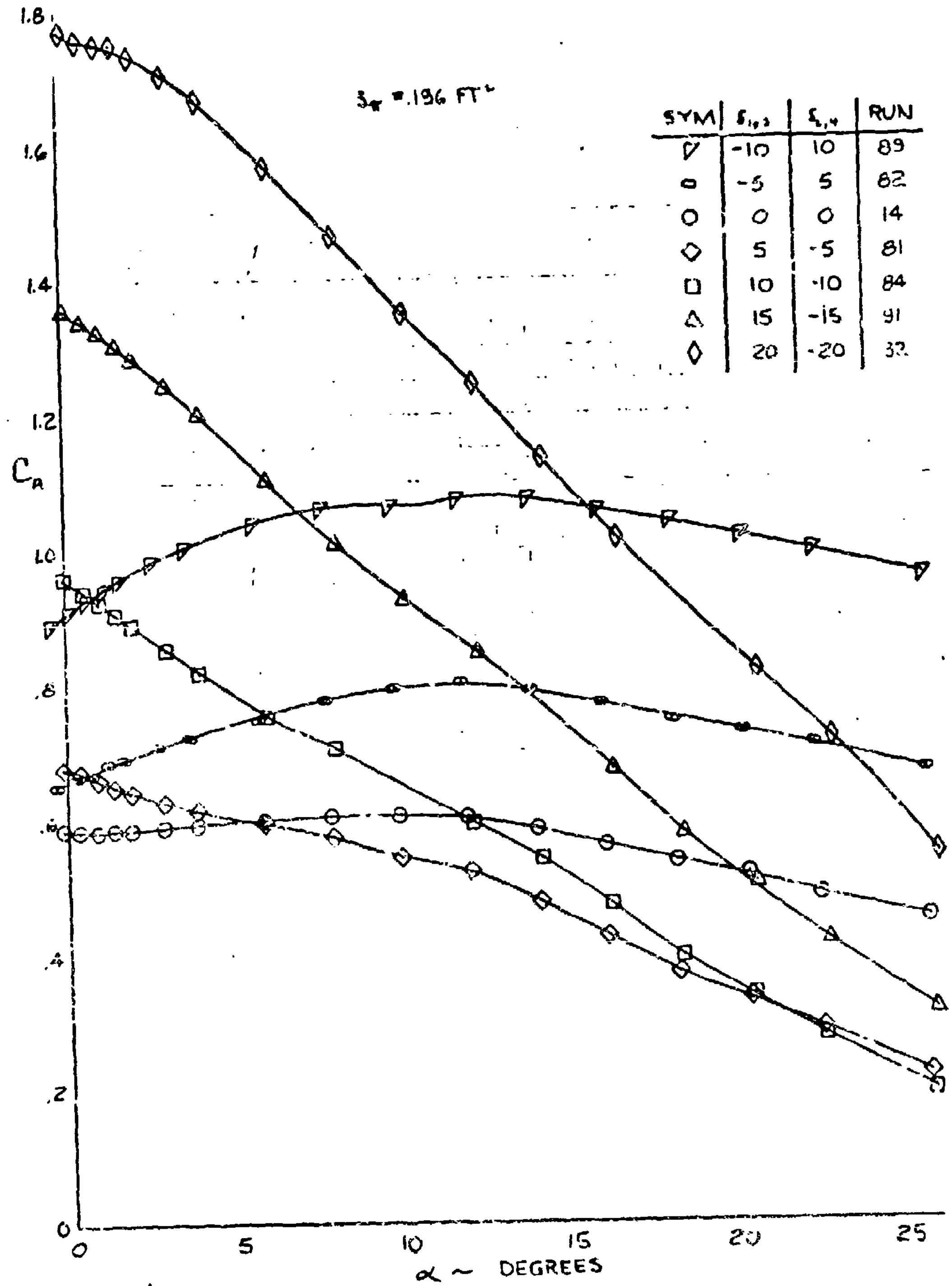


Fig 25. Axial force M = 1.0, ϕ = 45°, altitude = 4000 ft

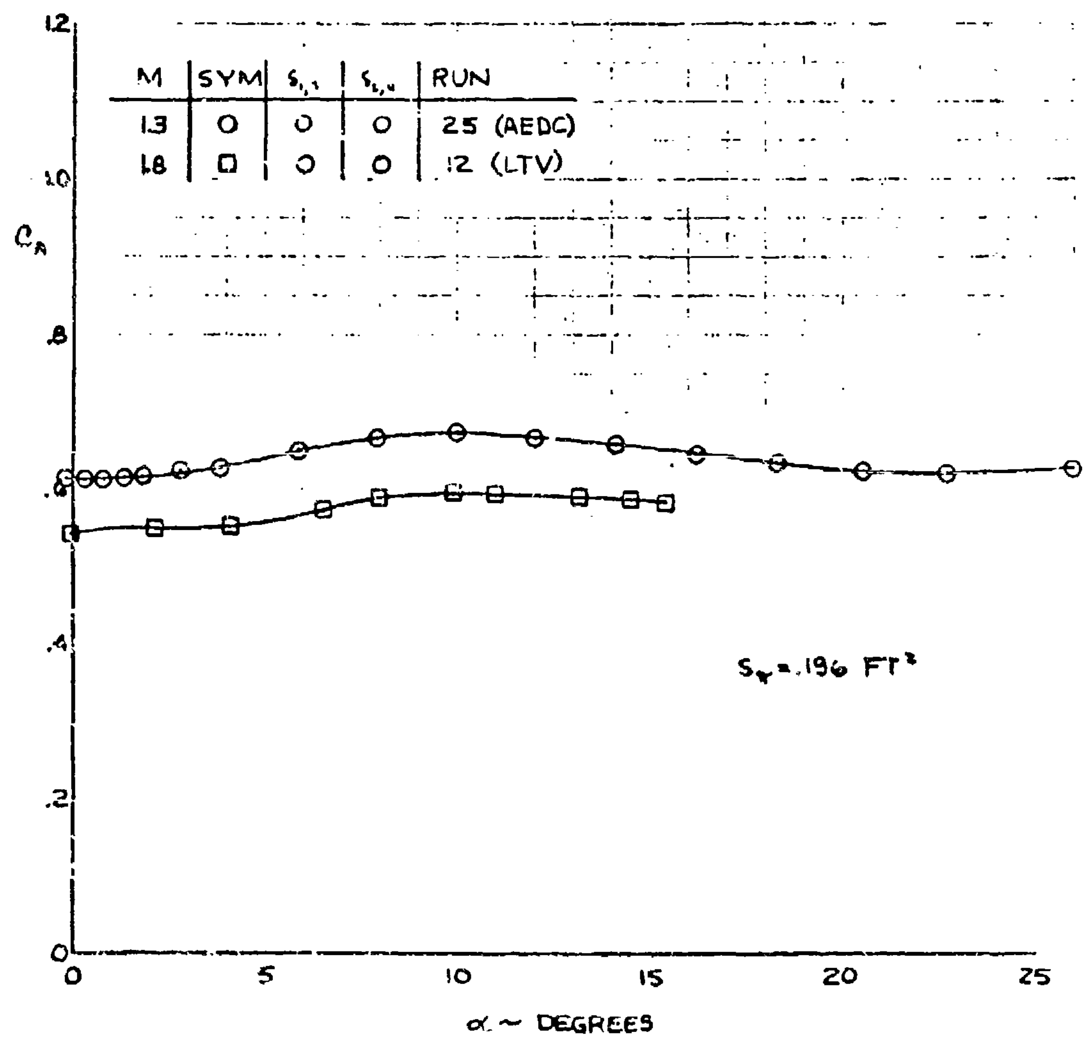


Fig 26. Axial force M = 1.3 & 1.8, $\phi = 0°$, altitude = 4000 ft, $\delta_{1,3} = \delta_{2,4} = 0$

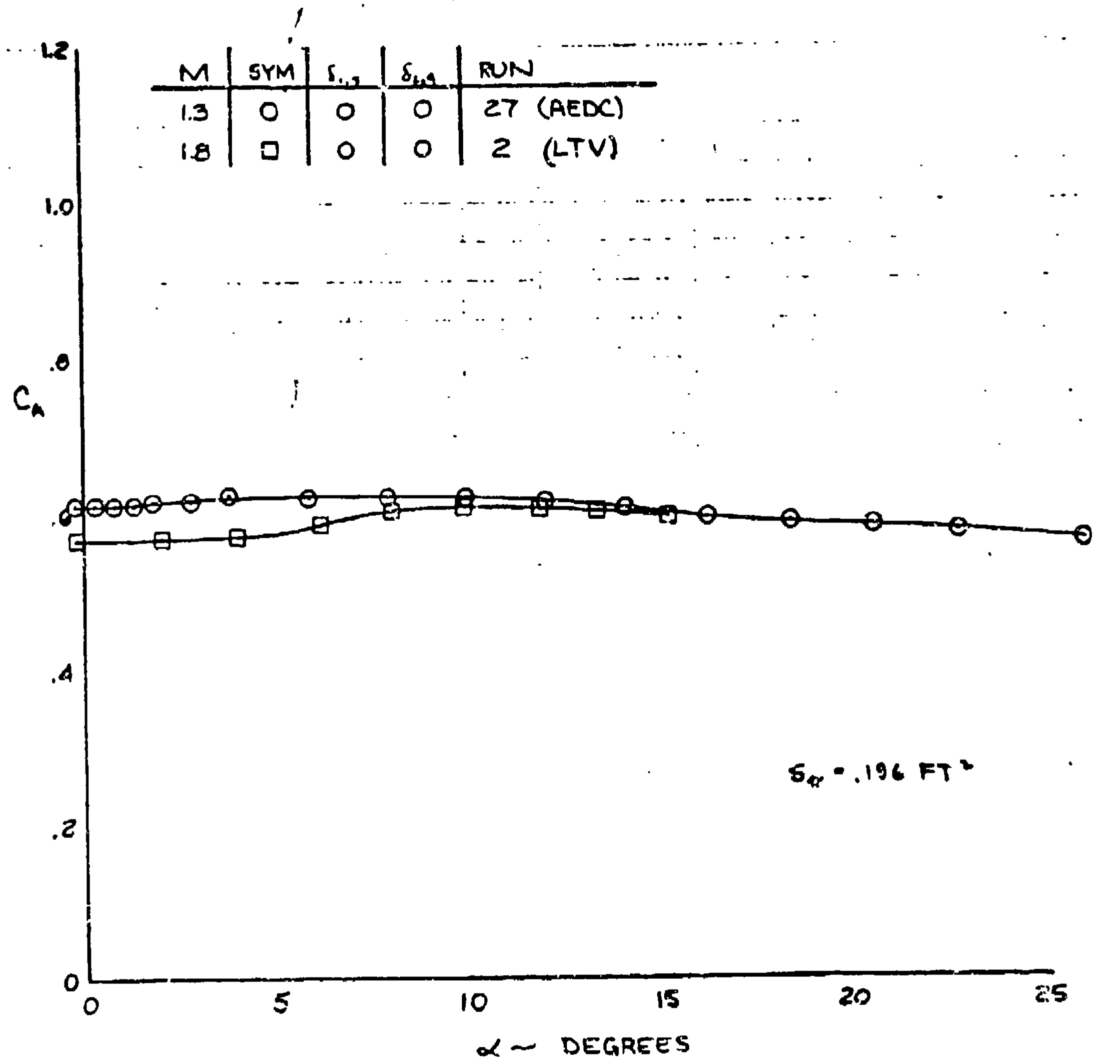


Fig 27. Axial force M = 1.3 & 1.8, ϕ = 45°, altitude = 4000 ft.
$\delta_{1,3} = \delta_{2,4} = 0$

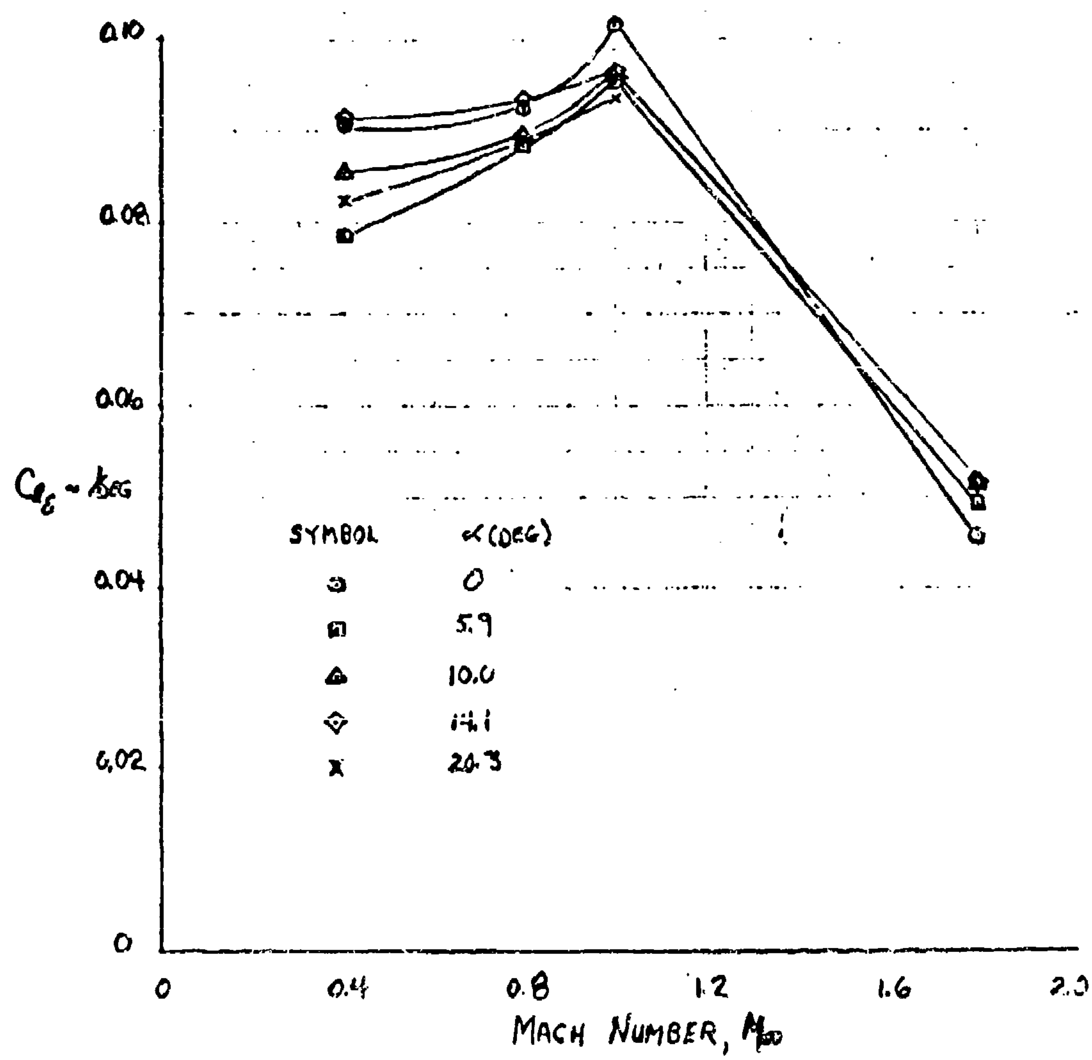


Fig 28. Roll power, C_{ℓ_δ}, $\phi = 0°$

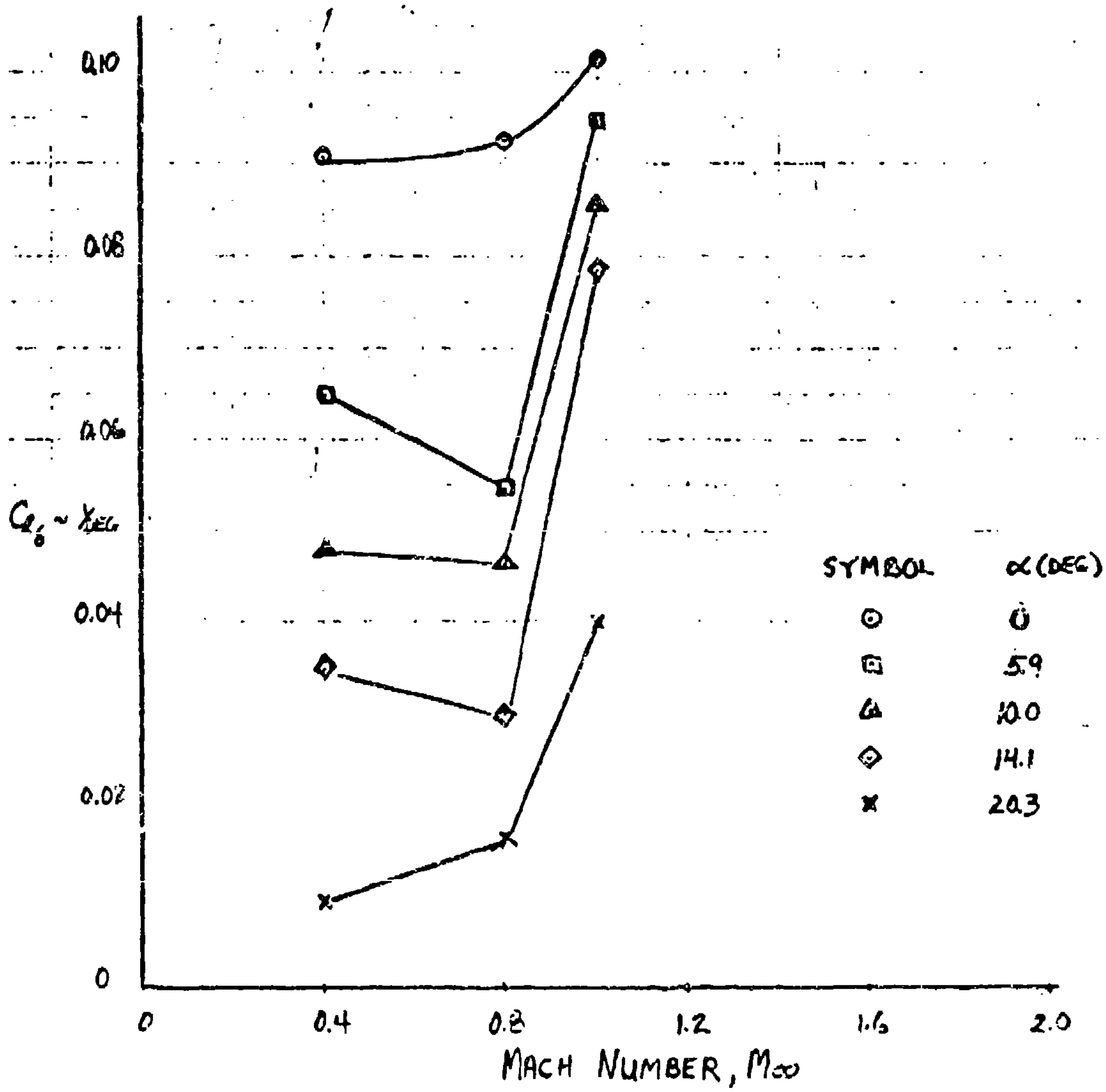


Fig 29. Roll power, C_{ℓ_δ}, $\phi = 45°$

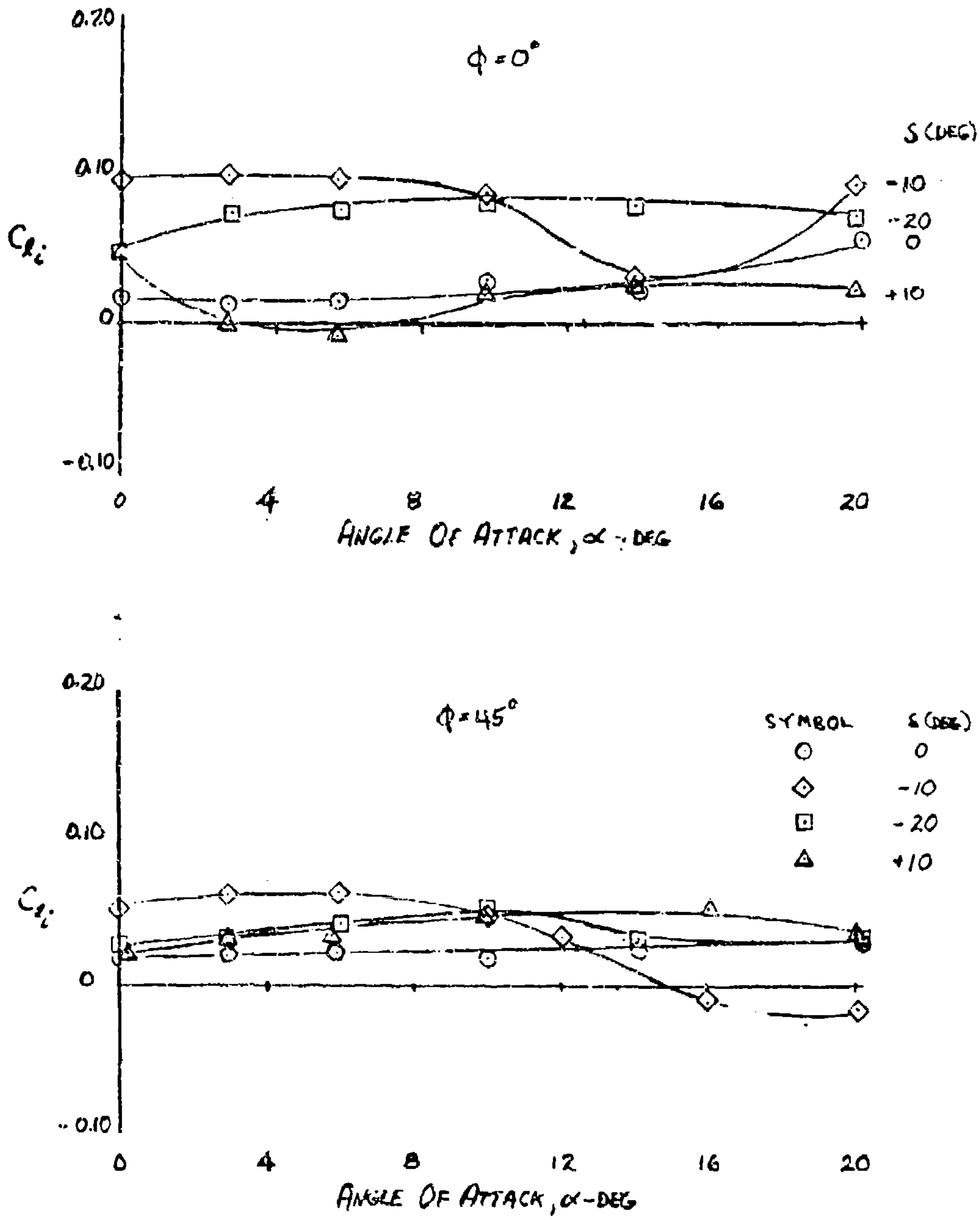


Fig 30. Induced roll coefficient, $M_\infty = 0.4$

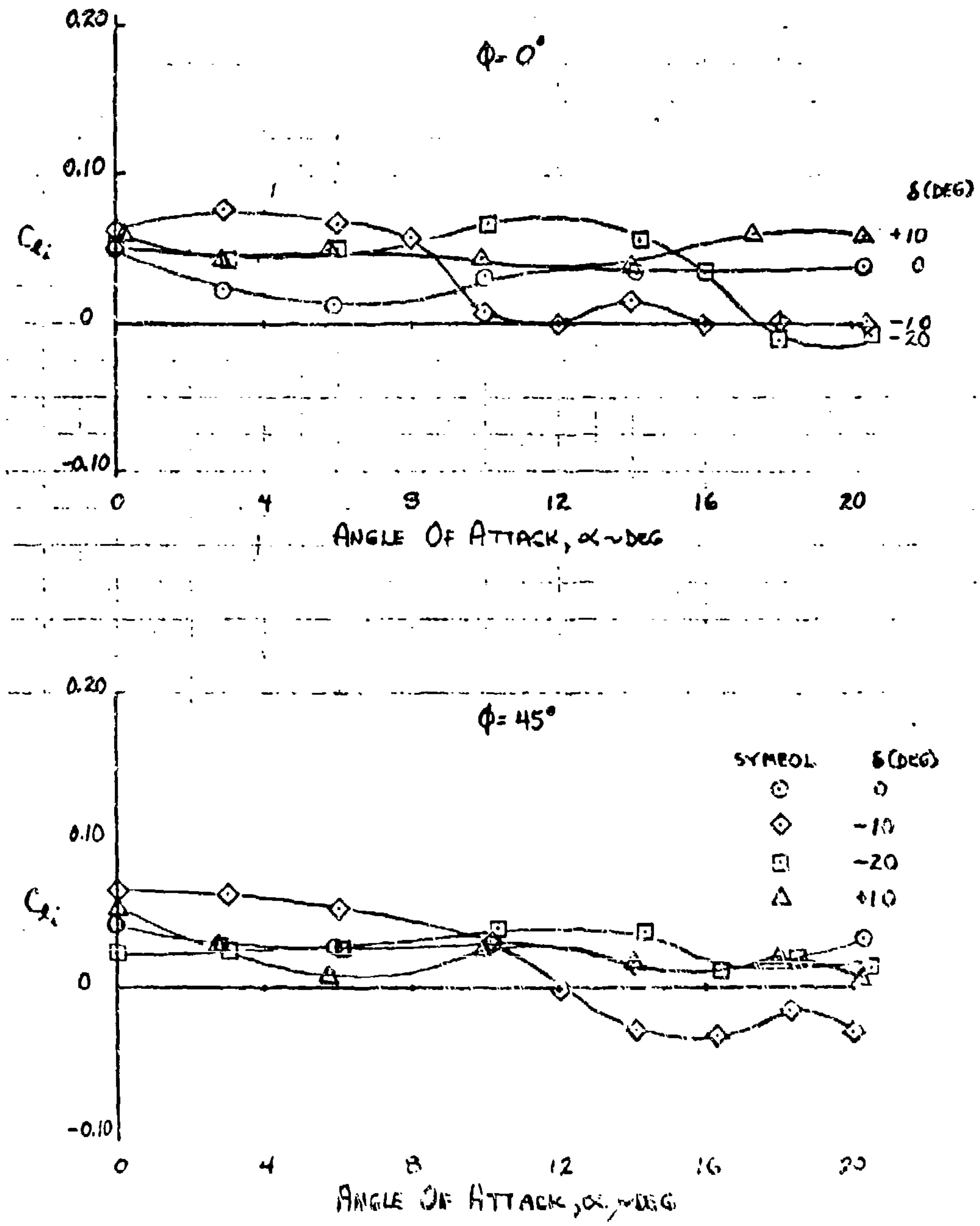


Fig 31. Induced roll coefficient, $M_\infty = 0.8$

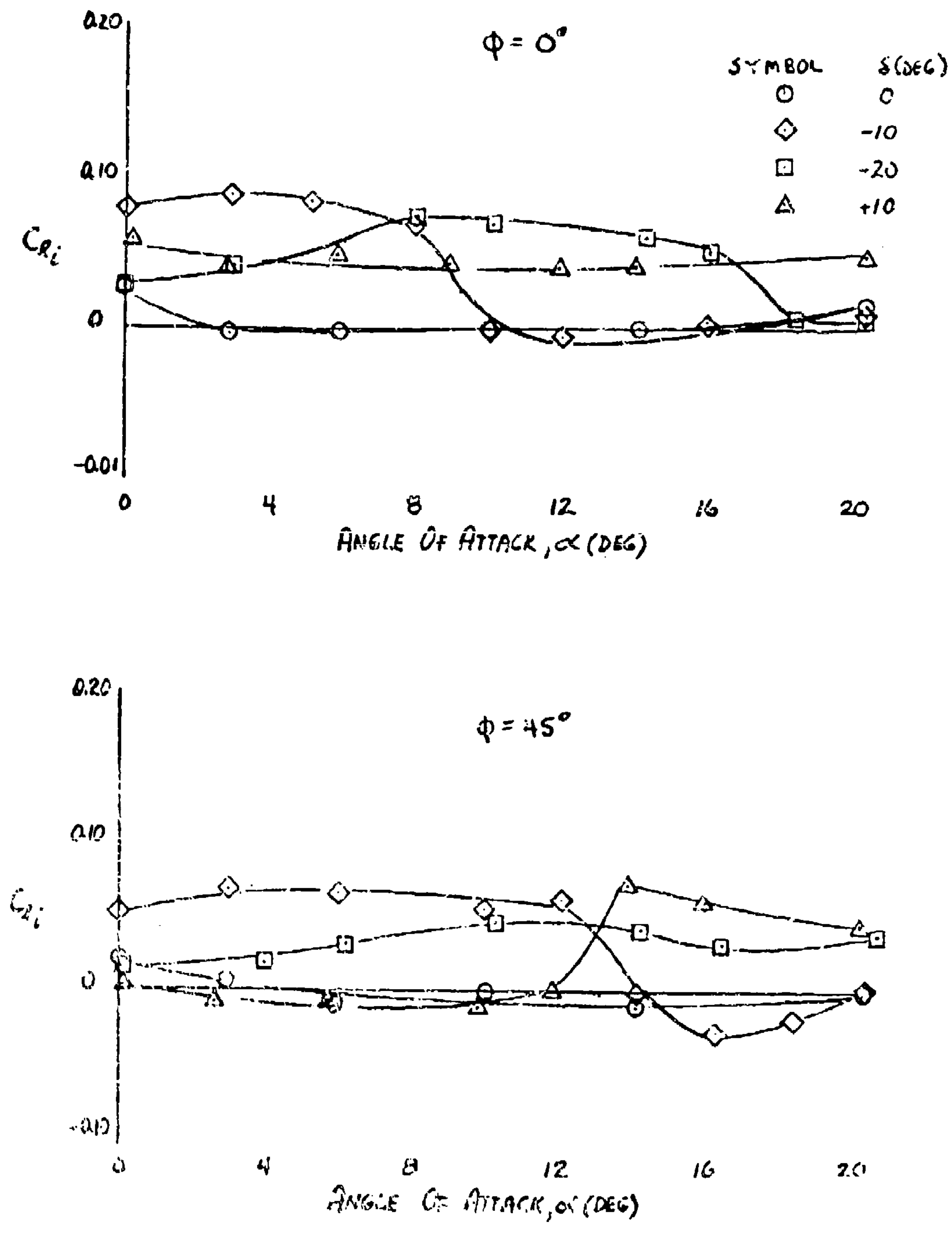


Fig 32. Induced roll coefficient, $M_\infty = 1.0$

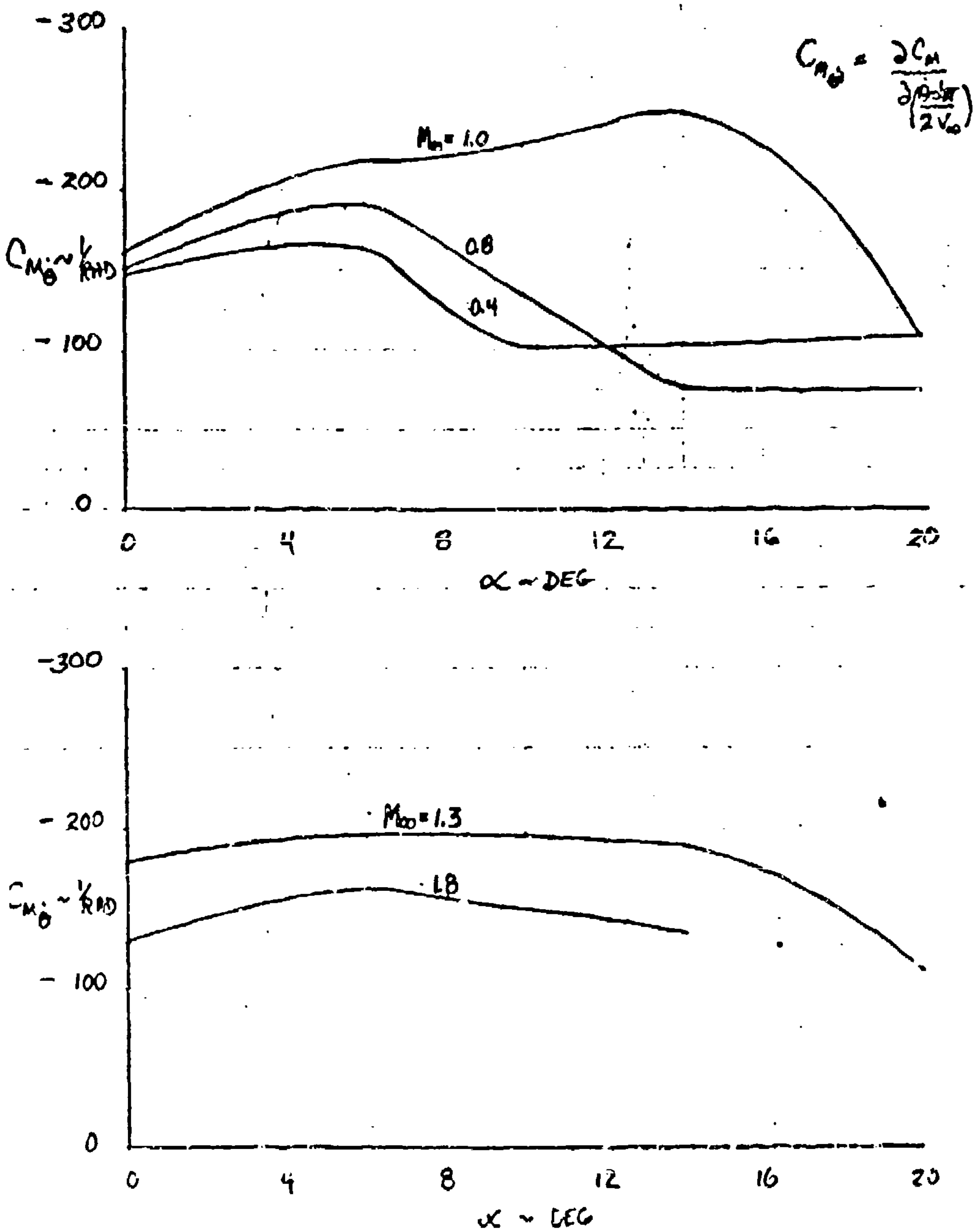


Fig 33. Pitch damping, δ = 0°

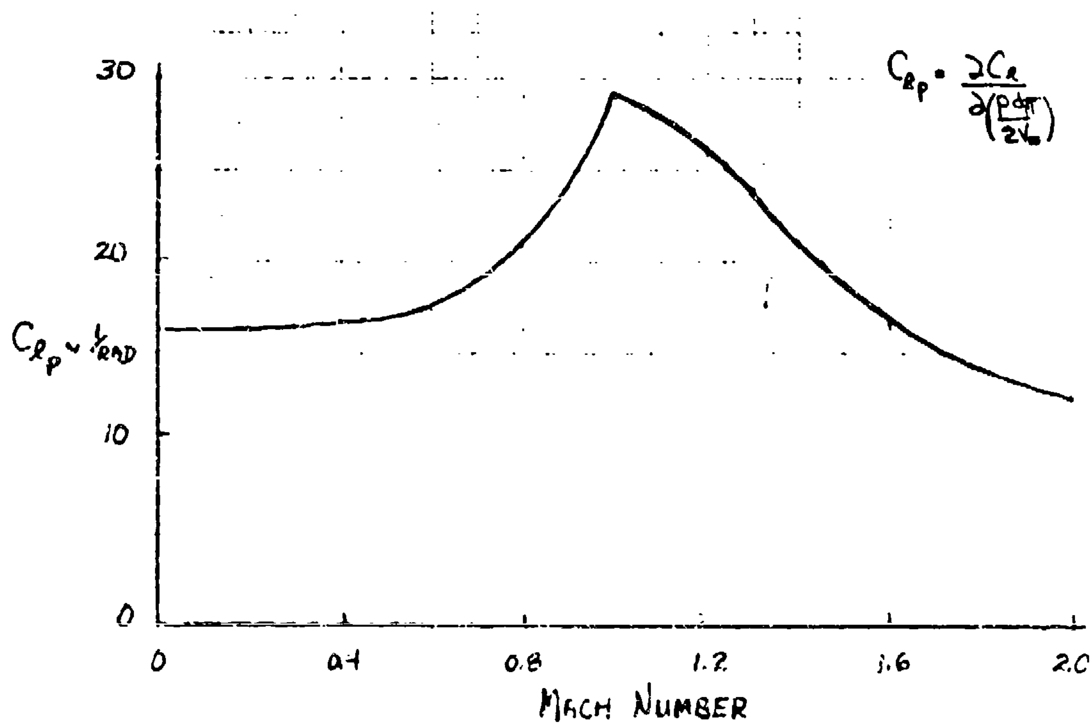


Fig 34. Roll damping, C_{ℓ_p}, $\alpha = 0°$

APPENDIX C

CANNON-LAUNCHED GUIDED PROJECTILE AERODYNAMIC DATA

XM712 ED configuration

GEOMETRY AND MASS PROPERTIES

These are presented in Figure 35.

AERODYNAMIC PROPERTIES

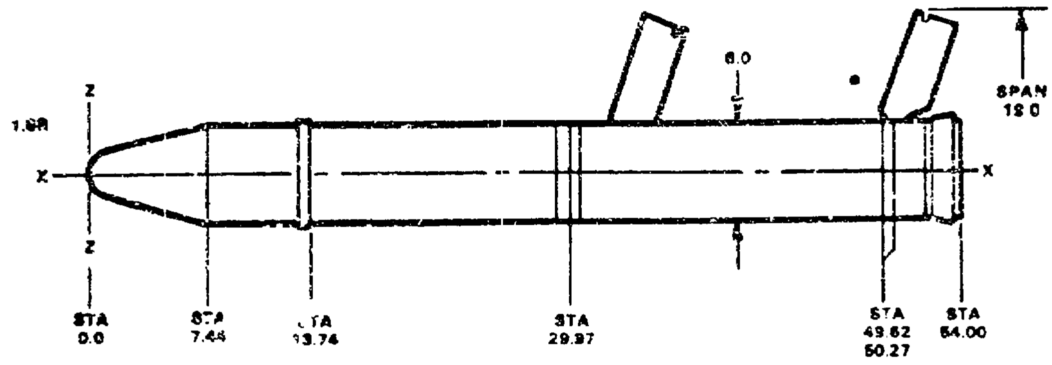
Static stability, drag buildup, and control effectiveness data were obtained from a 75-percent scale model wind tunnel test conducted in March 1975. Theoretical calculations were performed to define the dynamic damping coefficients. The values calculated were then correlated with similar data for the AD CLGP, with good agreement. No aerodynamic cross coupling and control interaction effects were measured.

The aerodynamic data on Figures 36 through 49 are presented in a body axis system about a center of gravity located 5.17 calibers aft of the nose. The reference area is 0.196 ft^2 and the reference length is 0.5 foot.

Potentially critical configuration areas have been minimized in the proposed configuration. The fins were sized to provide a one-half caliber static margin at the highest launch Mach number. The wings were then sized to maximize trim load factor capability at the lower mach numbers that will be encountered in maneuvering flight, and at the same time, be compatible with the span restrictions imposed by the foldout concept.

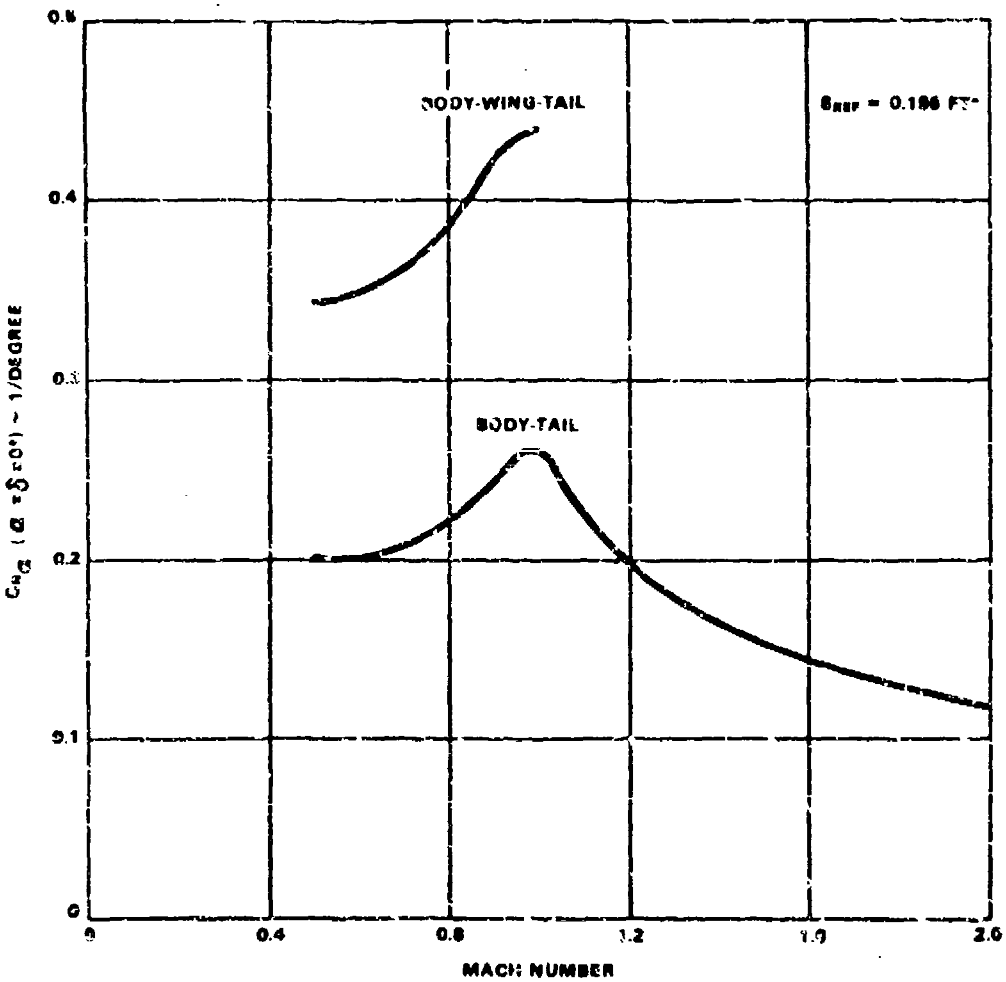
Model buildup runs were conducted to provide critical evaluation of forebody, base, fin, and wing drag. The effects of bourrelets, open slotted control housing, and engraved obturator were evaluated during AD testing. These data confirm predicted configuration range performance.

During AD flight testing, configuration instabilities arising from aerodynamic cross coupling were experienced. Consequently these cross coupling coefficients were estimated



ITEM	WT (LB)	CG STS (IN)	I_x (SLUG-FT^2)	I_y (SLUG-FT^2)
SEEKER ASSEMBLY	(7.00)	(4.88)	(0.0058)	(0.0091)
DOME & COIL ASSEMBLY	2.35	3.03	0.018	0.0018
GYRO & STARTER ASSEMBLY	2.40	4.78	0.0011	0.0016
STRUCTURE & MISCELLANEOUS	2.25	6.93	0.0031	0.0018
ELECTRONICS ASSEMBLY	(13.30)	(10.92)	(0.0173)	(0.0174)
STRUCTURE 4130 STEEL	4.90	11.32	0.0084	0.0075
GAS RATE SENSOR	0.39	7.60	—	—
BULKHEADS	2.73	11.87	0.0034	0.0050
PWBA	5.28	10.30	0.0046	0.0024
WARHEAD, REV.	(49.80)	(23.79)	(0.0661)	(0.3759)
CONTROL ASSEMBLY	(64.72)	(43.46)	(0.0843)	(0.7185)
COUPLING	1.38	29.97	0.0028	0.0015
HOUSING (4340 STEEL)	29.40	41.10	0.0503	0.2838
PRESSURE BULKHEAD ASSEMBLY	7.85	53.03	0.0097	0.0048
ACTUATING & LOCK MECHANISM	4.03	35.70	0.0021	0.0159
WINGS (4) (ALUMINUM)	0.92	36.45	0.0008	0.0011
FINS (4) (17-4PH STEEL)	3.00	46.77	0.0014	0.0042
CONTROL PKG (TWO 24-IN) HE BOTTLES)	14.00	46.72	0.0126	0.0492
BATTERY	2.20	44.65	0.0015	0.0017
SWITCHES, WIRING, SENSORS, MISCELLANEOUS	2.16	40.79	0.0034	0.0108
TOTAL, LAUNCH CONDITION	134.6	30.99	0.175	8.03
TOTAL, FINS EXTENDED	134.6	31.06	0.193	8.13
TOTAL, WINGS & FINS EXTENDED	134.6	31.07	0.196	8.13

Fig 35. Geometry and mass properties



NORMAL FORCE COEFFICIENT SLOPE VERSUS MACH NUMBER

Fig 36. Normal force coefficient slope versus Mach number

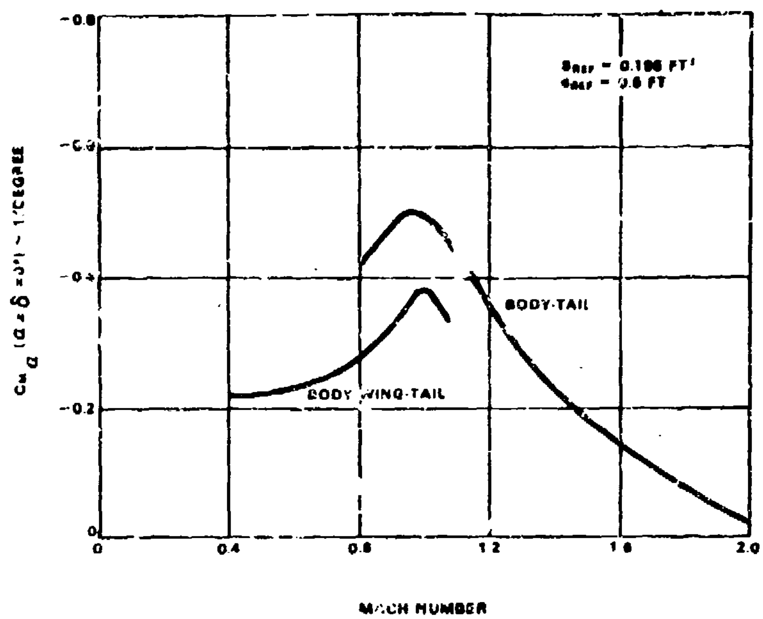


Fig 37. Pitching moment coefficient slope versus Mach number

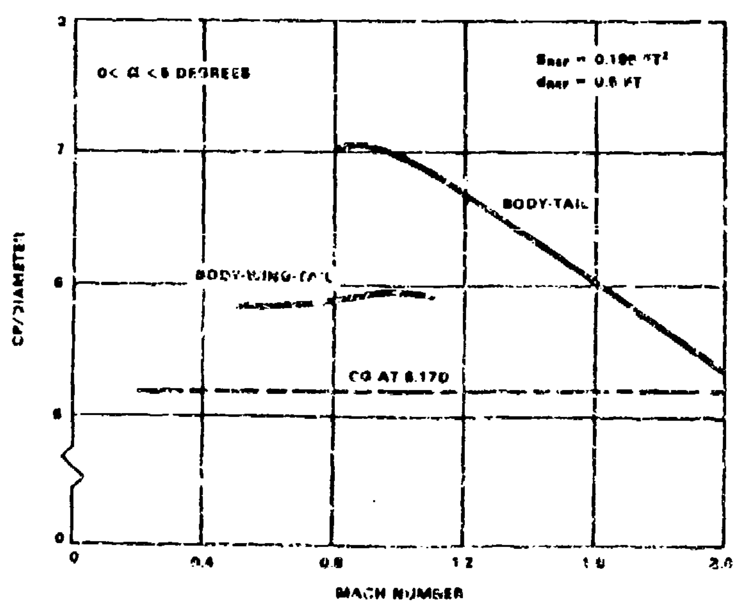


Fig 38. Center of pressure versus Mach number

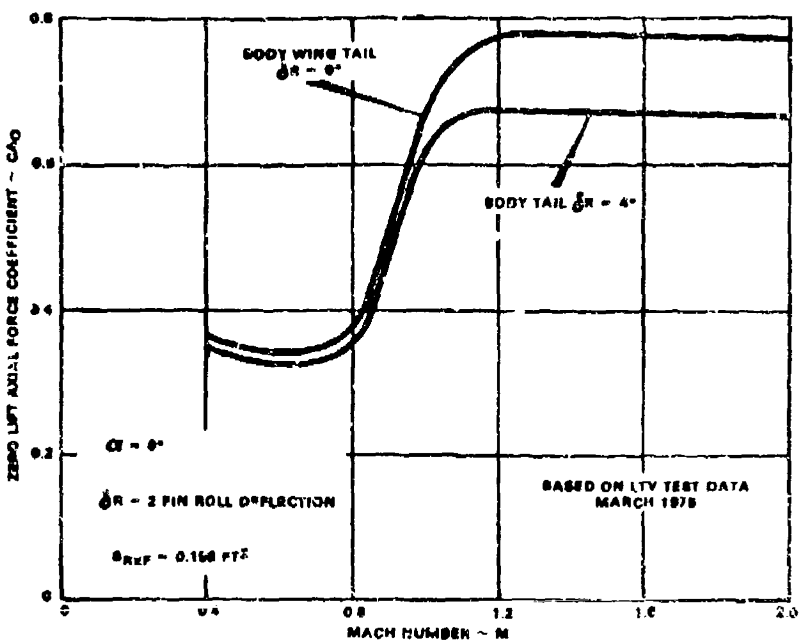


Fig 39. Axial force coefficient versus Mach number

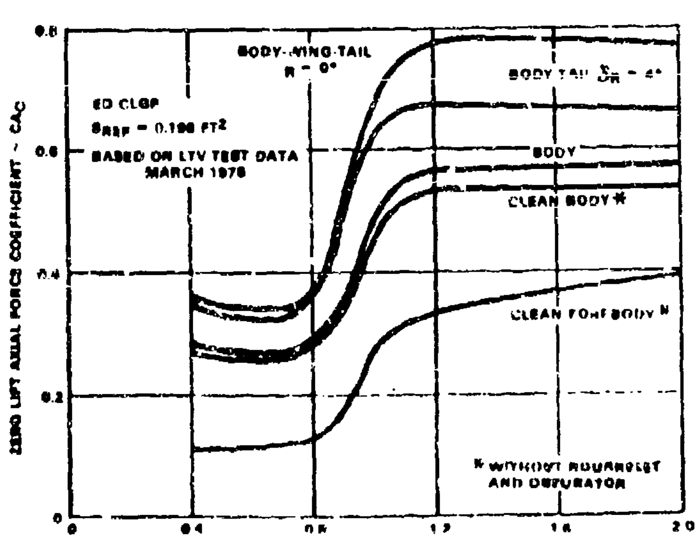


Fig 40. Axial force coefficient breakdown

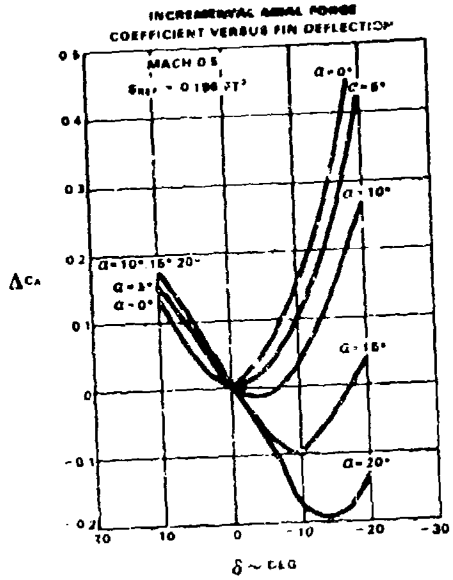


Fig. 41. Incremental axial force coefficient versus fin deflection, M = 0.5

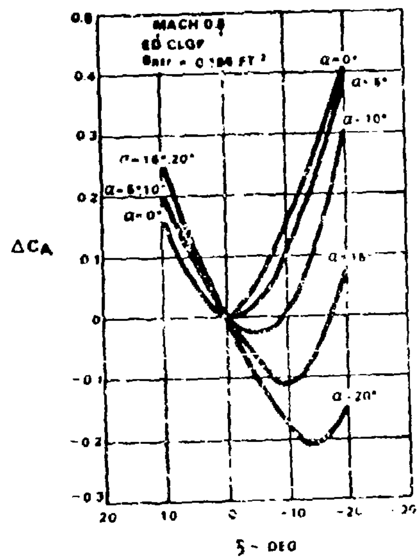


Fig. 42. Incremental axial force coefficient versus fin deflection, M = 0.8

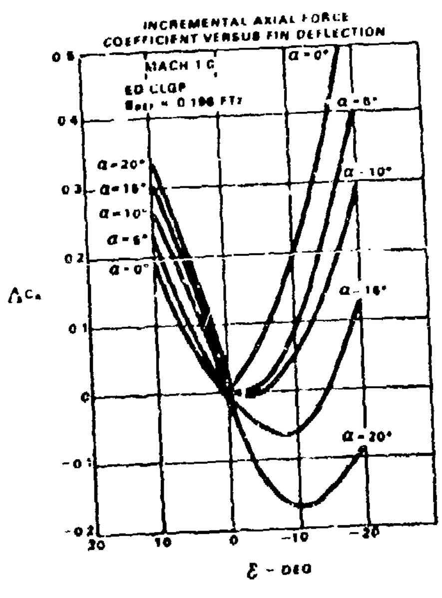


Fig. 43. Incremental axial force coefficient versus fin deflection, M = 1.0

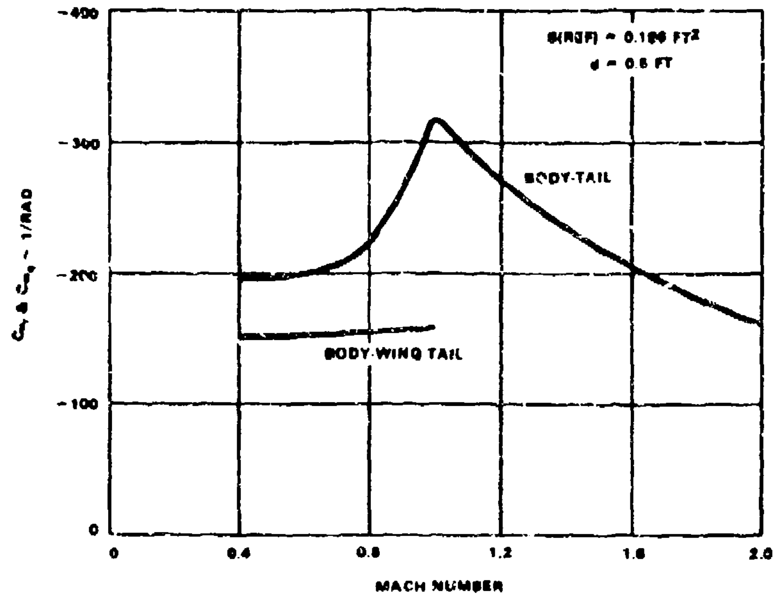


Fig 44. Pitch and yaw damping derivatives versus Mach number

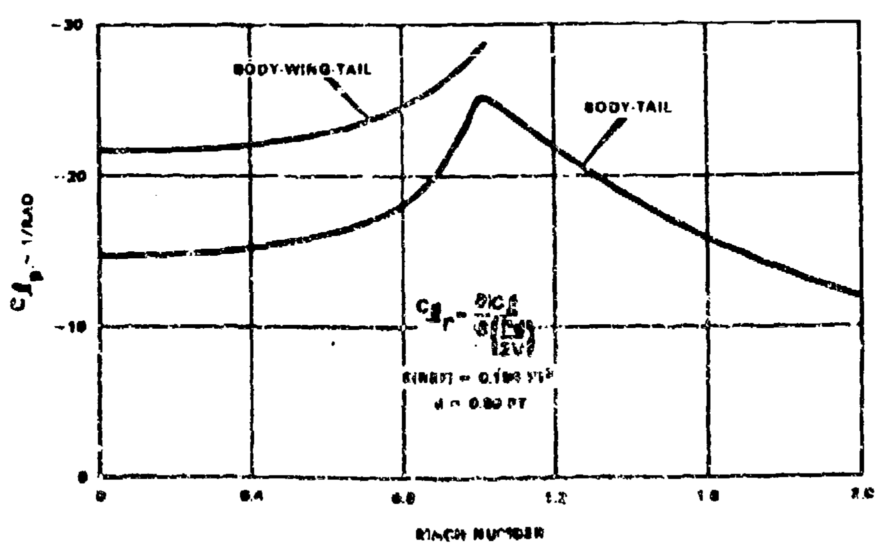


Fig 45. Roll damping derivative

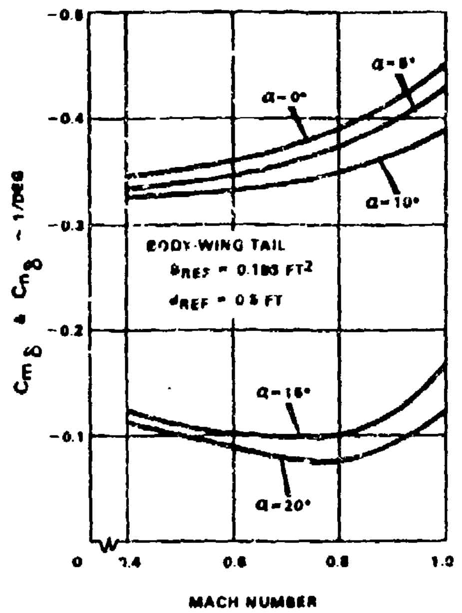


Fig 46. Fin power in pitch and yaw versus Mach number

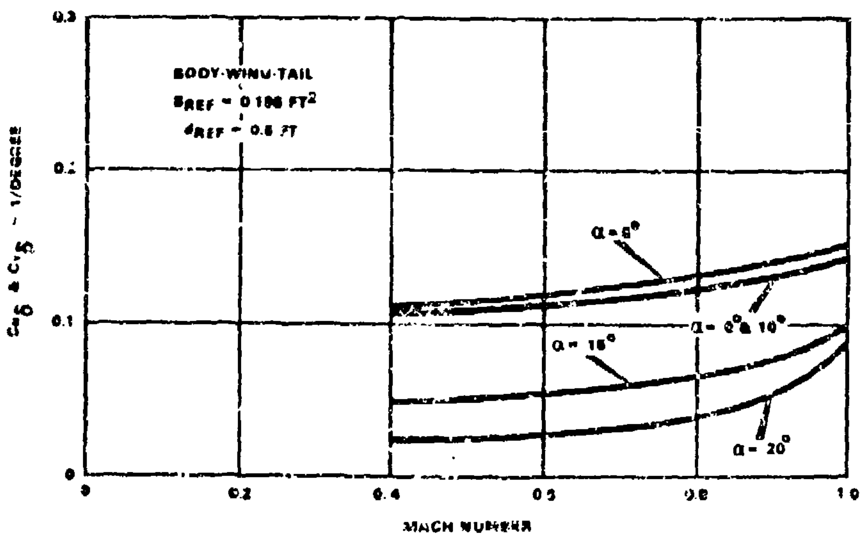


Fig 47. Normal force and side force coefficient slope with fin deflection versus Mach number

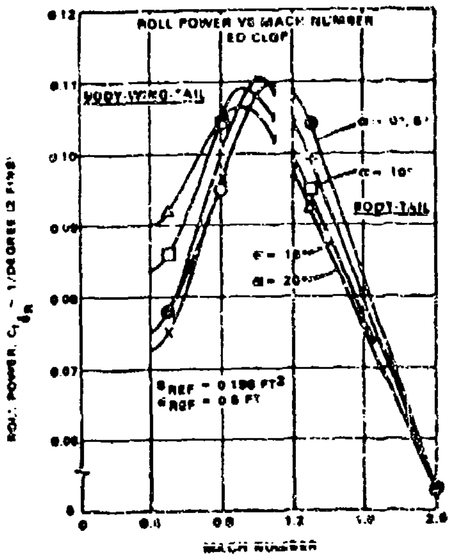


Fig 48. Roll power versus Mach number

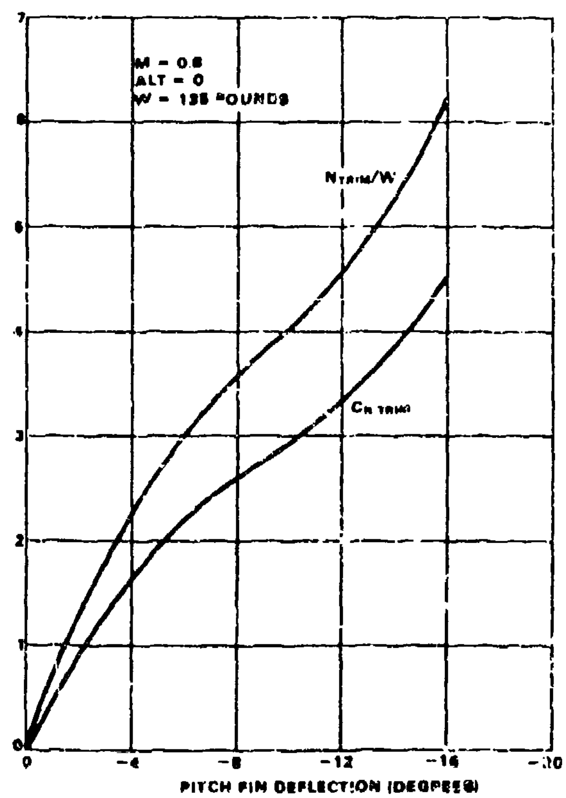


Fig 49. Trimmed load factor and $C_{N_{trim}}$ versus pitch fin deflection

APPENDIX D

CANNON-LAUNCHED GUIDED PROJECTILES RECOMMENDED WIND-TUNNEL TEST PROGRAMS

Canard-controlled fixed-tail design

Early ED Wind Tunnel Test for Design Purposes

Test Outline

I. Body and Tail (controls undeflected, rolling & nonrolling).

A. Test Conditions (except as noted, number in parentheses is number of values of that variable)

1. Mach No.: 0.4, 0.8, 0.9, 0.95, 1.0, 1.1, 1.25, 1.5, 2.0 (9)

2. Angles of Attack: +6°, +4°, +2°, +1°, +0.5°, -1°, -2°, -4°, -6°, -8°, -10°, -12°, -14°, -16°, -18°, -20° (18)

3. Yaw Angles: 0° (1)

4. Roll Angles (N.A. when rolling): 0°, 22.5°, 45°, 67.5°, 90° (5)

5. Roll Rates: pd/2V = 0, 0.0075, 0.015, 0.030 (4)

B. Number of Runs (one run is one angle of attack sweep).

1. Mach = 0.8, Roll Angles = 0°, 90°, 180°, 270°:	4
(correct any model asymmetries detected.)	
2. I. A. 1-5 (rolling)	27
contingency runs	13
3. I. A. 1-5 (nonrolling)	45
contingency runs	22
4. Total	111

C. Revise design as required.

II. Body and Tail and Canards (controls undeflected)

A. Test Conditions

1. Mach No.: 0.8, 0.9, 0.95, 1.0 (4)

2. Angles of Attack: Same as I

3. Yaw Angles: Same as I (1)

4. Roll Angles: Same as I (5)

5. Roll Rat pd/2V = 0, 0.015 (3)

B. Number of Runs

1.	M = 0.8, Roll Angles = 0°, 90°, 180°, 270°: (correct asymmetries)	4
2.	II. A. (nonrolling)	20
	contingency runs	10
3.	II. A. (rolling)	8
	contingency runs	4
4.	Total	46

III. Body and Tail Canards (controls deflected)

A. Test Conditions

1. Mach No.: Same as II (4)

2. Angles of Attack: Same as I

3. Yaw Angles: Same as I (1)

4. Roll Angles: A: 0°, 22.5°, 45°, 67.5°, 90° (5)

   B: A plus 112.5°, 135°, 157.5° (8)

5. Roll Rates: pd/2V = 0, 0.0075, 0.015 (3)

6. Control Deflections

   a. Roll Program A at all Mach No.: (nonrolling)
      pitch: +5°, −5°, −7.5°, −10° (4)
      yaw: 0° (1)

   b. Roll Program A at all Mach No.: (nonrolling)
      pitch: 0° (1)
      yaw: −5°, +5°, 7.5°, +10° (4)

   c. Roll Program B (nonrolling)
      pitch: +5°, −5°, −10° (3)
      yaw: −5°, +5°, +10° (3)

B. Number of Runs

1. Nonrolling

   a. pitch deflection only: 80

   b. yaw deflection only: 80

   c. pitch and yaw 288

   d. Total 448

2. Rolling

   a. pitch deflection only: 32

   b. yaw deflection only: 32

   c. pitch and yaw: 72

   d. Total 136

C. Revise Design as Required

IV. Grand Total of Runs: 741 (minimum)

V. General Test Considerations

A. Test Methods

1. Six component balance.

2. Base pressure measurements will be taken at least at 4 points.

3. Model will represent expected flight condition (either engraved obturator on or off).

4. Flow visualization techniques will be used.

B. Test Models/Facilities

1. 0.5 percent blockage ratio not to be exceeded at full control deflections and zero angle of attack.

2. Test Reynolds number should be as close to flight Reynolds number as possible; and not below 2×10^6 (based on diameter) at Mach 1.0.

3. Facilities

a. NASA Unitary Tunnels, Ames Laboratory.

(1) High Reynolds Number. Can match flight on a full-scale model.

(2) A full-scale model would have less than 0.5 percent blockage ratio.

(3) Match number range is 0.7 to 1.4 in 11-foot by 11-foot and 1.5 to 2.5 in 9-foot by 7-foot tunnel.

(4) Available at no cost.

(5) Availability of test time depends on national priority. (High Army priority means 6 to 12 month wait.)

(6) Low number of runs per hour (≈ 2)

b. CALSPAN 8-foot by 8-foot.

(1) Capable of exceeding a Reynolds number of 2×10^6 throughout controlled flight Mach number regime.

(2) A full-scale model would have less than 0.5 percent blockage ratio.

(3) Mach number range is 0.1 to 1.3.

(4) Another tunnel is required for supersonic testing.

(5) Cost is $1500 per hour.

(6) Test time available immediately.

(7) Very high number of runs per hour ($\approx$10) with remotely controlled spin and control surfaces.

c. AEDC 4T with Supersonic Blocks

(1) Capable of exceeding a Reynolds number of 2×10^6 at M=1.6 and 2.0.

(2) Blockage requirements are not limiting for supersonic conditions.

(3) Mach numbers are 1.6 and 2.0.

(4) This is considered the main choice tunnel for supersonic testing.

(5) Cost is $720 per hour.

(6) Availability of test time depends upon DOD priority.

(7) High number of runs per hour ($\approx$6) with remotely controlled spin and control surfaces.

d. AEDC 16-foot by 16-foot.

(1) Can maintain $Re = 2 \times 10^6$ (based on diameter) at all Mach numbers up to 1.6.

(2) A full-scale model would not exceed 0.5 percent blockage.

(3) Cost is $1400 per hour of tunnel occupancy.

(4) Availability of test time depends upon DOD priority.

(5) High number of runs per hour (≈ 6) with remotely controlled fins and spin.

4. Models

a. Use of existing model would not allow spin control or remote control setting of fin deflections.

b. Use of proposed 3/4 scale model would allow remote control of fins but would not allow spin control.

c. (1) A model incorporating the features in (a) must be built.

(2) The test time required for the transonic portion of the final test program is probably too long at any NASA tunnel.

VI. Recommendations:

A. The NASA tunnels have been discussed because they are available at no cost. But if a high national priority cannot be established, the time delay in getting into these tunnels renders them useless. Therefore, it is recommended that the CALSPAN 8-foot by 8-foot tunnel be used for transonic testing (it is available on call) and the AEDC 4T with supersonic blocks be used for supersonic testing.

B. The same order of recommendations is made for the final aerodynamic data package required. Scheduling will be tighter here, and the NASA tunnels are definetely out.

C. In light of the Reynolds number problem and the final configuration aerodynamic testing required later in ED, it is recommended that the early ED testing be done with a full-scale, remotely controlled spin and control surfaces model.

Minimum Wind Tunnel Test Program of Final Configuration:

Wind Tunnel Test Requirements.

1. Test configuration will be full-scale, preferably based on actual hardware to reduce model costs and for surface finish, and Reynolds' number matching.

2. Test configuration will be expected flight configuration, e.g., obturator either on or off as intended. If obturator is on, it should be engraved.

3. All tests will be made with a 6-component balance plus instrumentation to obtain hinge forces and moments on control surfaces. Base pressure will be measured.

4. The model must be capable of remote and independent control of all control surfaces and of model spin rate.

5. These surface variations must be set within 0.002° and data on all control variations and the spin rate must be available continuously during a tunnel run.

6. Base pressure measurements will be taken at least at one radius every 90°; this radius should be half-way between the sting and the edge of the base of the projectile. The pressure taps should be in the base and the plumbing routed inboard and then out along the sting. External rakes should not be used.

7. Data reduction will include plots of all force and moment coefficients as functions of all variables in test.

8. Flow visualization techniques will be employed at all times.

9. Read also the Early ED Test Plan. Give special attention to Section V - a discussion of Model/Facility choice.

10. If full-scale controllable model was used in early ED, the model is already available and paid for. Any testing done in early ED on same external configuration as final design doesn't have to be done again and their time and costs may be deducted from this plan.

Test Outline

I. Body Alone

A. Test Condition (number in parentheses is number of values of that variable)

1. Mach No.: 0.4, 0.6, 0.8, 0.9, 0.95, 1.0, 1.05, 1.1, 1.25, 1.50, 2.0 (11)

2. Angles of Attack: +6°, +4°, +2°, +1°, 0.5°, 0°, −0.5°, −1°, −2°, −4°, −6°, −8°, −10°, −12°, −14°, −16°, −18°, −20° (18)

3. Roll Angles: 0°, 22.5°, 45°, 67.5°, 90°, 180°, 270° (7)

4. Yaw Angle: 0° (1)

B. Number of Runs (considering an angle of attack sweep as one run): 77

C. Any model asymmetries detected should be corrected and any flow asymmetries noted for correction of data.

II. Body and Tail (rolling and nonrolling)

A. Test Conditions

1. Mach No.: Same as I (11)

2. Angles of Attack: Same as I.

3. Roll Angles: 0°, 22.5°, 45°, 67.5°, 90°, 112.5°, 135°, 157.5°, except as noted (8)

4. Yaw Angles: 0° (1)

5. Roll Rates: $pd/2V = 0, 0.0075, 0.015, 0.030$ (4)

6. Control Deflections: 0 (1)

B. Number of Runs

1. $p = 0, \phi = 0°, 180°, 270°, M = 0.8$: 4 (Asymmetry check)

2. $p = 0$: 88

3. $p \neq 0$: 33

4. Total 125

C. Correct any model asymmetries detected in II.B.1 and note flow asymmetries.

III. Body and Tail and Canards (No control deflections).

A. Test Conditions

1. Mach No.: 0.4, 0.8, 0.9, 0.95, 1.0 (5)

2. Angles of Attack: Same as I.

3. Roll Angles: Same as II (8)

4. Yaw Angles: Same as I (1)

5. Roll Rates: Same as II (4)

6. Control Deflections: 0° (1)

B. Number of Runs

1. $p = 0$: 40 runs

2. $p \neq 0$: 15 runs

55 runs

IV. Body and Tail and Canards (controls deflected, no roll rate)

A. Test Conditions are the same as the early ED plan except Mach No. are the same as III (5).

B. Number of Runs

1. pitch deflection only: 100

2. yaw deflection only: 100

3. pitch and yaw: 360

4. Total 560

V. Body and Tail and Canards (controls deflected, rolling)

A. Test Conditions are the same as IV.

B. Number of Runs (same as early ED).

1. pitch deflection only: 40

2. yaw deflection only: 40

3. pitch and yaw: 90

4. Total 170

VI. Dynamic Testing

A. Test Conditions

1. Mach No.:

a. Body: Same as I (11)

b. Body and Tail: Same as I (11)

c. Body and Tail and Canards: Same as III (5)

2. Angles of attack: 0° (1)

3. Roll Angles: 0°, 22.5°, 45° (3)

4. Yaw Angles: 0°

5. Roll Rates: 0°

6. Control Deflections: All 0

VI. A. 8. Configurations: Body, Body and Tail, Body and Tail and Canards (3)

B. Number of Runs

TOTAL: 81

VII. Total Number of Runs

A.	I:	77
B.	II:	125
C.	III:	55
D.	IV:	560
E.	V:	170
F.	VI:	81
G.	Total	1149

VIII. Cost and Time

A. Model(s): $50,000 (full-scale)

+$20,000 if two tunnels are used.

B. Tunnel Times (alternatives)

1. Ames Unitary Tunnels: 575 hours
2. CALSPAN 8' x 8' and Ames 9' x 7': 118 + 32 = 150 hours
3. CALSPAN 8' x 8' and AEDC 4T: 118 + 16 = 134 hours

C. Tunnel Costs

1. Ames Unitary Tunnels: 0
2. CALSPAN 8' x 8' and Ames 9' x 7': $177K + 0 = $177K

3. CALSPAN 8' x 8' and AEDC 4T: $177K + $12K = $189K

D. Total Costs (model & tunnel time)

1. Ames Unitary Tunnels: $50K

2. CALSPAN 8' x 8' and Ames 9' x 7': $247K

3. CALSPAN 8' x 8' and AEDC 4T: $259K

E. Estimated Priority Required to Obtain Tests on Time

1. High priority at national level.

2. Available immediately and high national priority.

3. Available immediately and medium priority at DOD level.

APPENDIX D

CANNON-LAUNCHED GUIDED PROJECTILES RECOMMENDED WIND-TUNNEL TEST PROGRAMS

Fixed-wing tail-controlled design

Early ED Wind Tunnel Test for Design Purposes

Test Outline

I. Body and Tail (controls undeflected, rolling and non-rolling)

A. Test Conditions (number in parentheses is number of values of that variable)

1. Mach No. 0.4, 0.8, 0.9, 0.95, 1.0, 1.1, 1.25, 1.50, 2.0 (9)

2. Angles of Attack: +6°, +4°, +2°, +1°, +0.5, 0°, −0.5°, −1°, −4°, −6°, −8°, −10°, −12°, −14°, −16°, −18°, −20° (18).

3. Yaw Angles: 0° (1).

4. Roll Angles: 0°, 22.5°, 45°, 67.5°, 90° (5) except as noted.

5. Roll Rates: pd/2V = 0, 0.015, 0.030 (3).

B. Number of Runs.

1. Mach = 0.8, Roll Angles = 0°, 90°, 180°, 270°: 4 (asymmetry check)

2. Non-rolling: 45
contingency runs: 22

3. Rolling 18
contingency runs: 9

4. Total 98

C. Revise design as required, correct model asymmetries.

II. Body and Tail and Wing (controls undeflected, non-rolling)

A. Test conditions (except as noted).

1. Mach No. 0.8, 0.9, 0.95, 1.0 (4)

2. Same as I

3. Yaw Angles: 0° (1)

4. Roll Angles: 0°, 22.5°, 45°, 67.5°, 90° (5)

B. Number of Runs (one run is one angle of attack sweep).

1. Mach = 0.8, Roll Angles = 0°, 90°, 180°, 270°: 4 (asymmetry check)

2.	II. A. 1.-5.:	20
	contingency runs	10
3.	Total	34

C. Revise design as required (correct model asymmetries).

III. Body and Tail and Wing (controls deflected, no rolling).

A. Test Conditions

1. Mach No.: Same as II (4).

2. Angles of Attack: Same as I.

3. Yaw Angles: 0° (1).

4. Roll Angles: A: 0°, 22.5°, 45°, 67.5°, 90° (5).

B: A plus 112.5°, 135°, 157.5° (8).

5. Control Deflections:

a. Roll Program A at all Mach No.

pitch: +5°, -5°, -10°, $-\delta_{P_{Max}}$ (4).

yaw: 0° (1).

roll: 0° (1).

b. Roll Program A at all Mach No.

pitch: $0°$ (1).

yaw: $-5°$, $+5°$, $+10°$, $+\delta_{Y_{Max}}$ (4).

roll: $0°$ (1).

c. Roll Program B at $M = 0.8$ and $\delta_R = 5°$, Program A elsewhere.

pitch: $0°$ (1).

yaw: $0°$ (1).

roll: $-2°$, $2°$, $5°$ (3).

d. Roll Program B at $M = 0.8$, Program A elsewhere.

pitch: $+5°$, $-5°$, $-10°$ (3).

Yaw: $-5°$, $+5°$, $+10°$ (3).

roll: $0°$ (1).

e. Roll Program B at $M = 0.8$, Program A elsewhere.

pitch: $-5°$, $+5°$ (2).

yaw: $0°$ (1).

roll: $-5°$, $+5°$ (2).

f. Roll Program B at $M = 0.8$, Program A elsewhere.

pitch: $0°$ (1).

yaw: $+5°$, $-5°$ (2).

roll: $-5°$, $+5°$ (2).

g. Roll Program B at M = 0.8, Program A elsewhere.

pitch: +5°, −5° (2).

yaw: −5°, +5° (2).

roll: −5°, +5° (2).

B. Number of Runs.

1.	pitch deflection only:	80
2.	yaw deflection only:	80
3.	roll differential deflection only:	63
4.	pitch and yaw:	207
5.	pitch and roll:	92
6.	yaw and roll:	92
7.	pitch, yaw, and roll:	184
8.	Total	798

C. Revise design as required

IV. Grand Total of Runs: 930 (minimum)

V. Grand Test Considerations.

A. Test Methods.

1. 6-component balance.

2. Base pressure measurements will be taken at least at 4 points.

3. Model will represent expected flight condition (either engraved obturator on or off).

4. Flow visualization techniques will be used.

B. Test Models/Facilities.

1. 0.5% blockage ratio not to be exceeded at full control deflections and zero angle of attack.

2. Test Reynolds number should be as close to flight Reynolds number as possible; and not below 2×10^6 (based on diameter) at Mach 1.0.

3. Facilities.

a. NASA Unitary Tunnels, Ames Laboratory.

(1) High Reynolds number - can match flight on a full-scale model.

(2) A full-scale model would have less than 0.5% blockage ratio.

(3) Mach number range is 0.7 to 1.4 in 11-foot by 11-foot and 1.5 to 2.5 in 9-foot by 7-foot tunnel.

(4) Available at no cost.

(5) Availability of test time depends on national priority. (High Army priority means 6 to 12 month wait.)

(6) Low number of runs per hour (≈2).

b. CALSPAN 8-foot by 8-foot.

(1) Capable of exceeding a Reynolds' number of 2×10^6 throughout controlled flight Mach number regime.

(2) A full-scale model would have less than 0.5% blockage ratio.

(3) Mach number range is 0.1 to 1.3.

(4) Another tunnel is required for supersonic testing.

(5) Cost is $1500 per hour.

(6) Test time available immediately.

(7) Very high number of runs per hour (≈10) with remotely controlled spin and control surfaces.

c. AEDC 4T with Supersonic Blocks.

(1) Capable of exceeding a Reynolds' number of 2×10^6 at M = 1.6 and 2.0.

(2) Blockage requirements are not limiting for supersonic conditions.

(3) Mach numbers are 1.6 and 2.0.

(4) This is considered the main choice tunnel for supersonic testing.

(5) Cost is $720 per hour.

(6) Availability of test time depends upon DOD priority.

(7) High number of runs per hour (≈6) with remotely controlled spin and control surfaces.

d. AEDC 16-foot by 16-foot.

(1) Can maintain Re = 2×10^6 (based on diameter) at all Mach numbers up to 1.6.

(2) A full-scale model would not exceed 0.5% blockage.

(3) Cost is $1400 per hour of tunnel occupancy.

(4) Availability of test time depends upon DOD priority.

(5) High number of runs per hour (≈6) with remotely controlled fins and spin.

4. Models

a. Use of existing model would not allow spin control or remote control setting of fin deflections.

b. Use of proposed 3/4-scale model would allow remote control of fins but would not allow spin control.

c. (1) A model incorporating the features in (a) must be built.

(2) The test time required for the transonic portion of the final test program is probably too long at any NASA tunnel.

VI. Recommendations:

A. The NASA tunnels have been discussed because they are available at no cost. But if a high national priority cannot be established, the time delay in getting into these tunnels renders them useless. Therefore, it is recommended that the CALSPAN 8-foot by 8-foot tunnel be used for transonic testing (it is available on call) and the AEDC 4T with supersonic blocks be used for supersonic testing.

B. The same order of recommendations is made for the final aerodynamic data package required. Scheduling will be tighter here and the NASA tunnels are definitely out.

C. In light of the Reynolds' number problem and the final configuration aerodynamic testing required later in ED, it is recommended that the early ED testing be done with a full-scale, remotely controlled spin and control surfaces model.

Minimum Wind Tunnel Test Program of Final Configuration:

Wind Tunnel Test Requirements.

1. Test configuration will be full-scale, preferably based on actual hardware to reduce model costs and for surface finish, and Reynolds' number matching.

2. Test configuration will be expected flight configuration, e.g., obturator either on or off as intended. If obturator is on, it should be engraved.

3. All tests will be made with a 6-component balance plus instrumentation to obtain hinge forces and moments on control surfaces. Base pressure will be measured.

4. The model must be capable of remote and independent control of all control surfaces and of model spin rate.

5. These surface variations must be set within 0.002° and data on all control variations and the spin rate must be available continuously during a tunnel run.

6. Base pressure measurements will be taken at least at one radius every 90°; this radius should be half-way between the sting and the edge of the base of the projectile. The pressure taps should be in the base and the plumbing routed inboard and then out along the sting. External rakes should not be used.

7. Data reduction will include plots of all force and moment coefficients as functions of all variables in test.

8. Flow visualization techniques will be employed at all times.

9. Read also the Early ED Test Plan. Give special attention to Section V - a discussion of Model/Facility choice.

10. If full-scale controllable model was used in early ED, the model is already available and paid for. Any testing done in early ED on same external configuration as final design doesn't have to be done again and their time and costs may be deducted from this plan.

Test Outline

I. Body Alone

A. Test Conditions (number in parentheses is number of values of that variable)

1. Mach No.: 0.4, 0.6, 0.8, 0.9, 0.95, 1.0, 1.05, 1.1, 1.25, 1.50, 2.0 (11)

2. Angles of Attack: +6°, +4°, +2°, +1°, 0.5°, -0.5°, -1°, -2°, -4°, -6°, -8°, -10°, -12°, -14°, -16°, -18°, -20° (18)

3. Roll Angles: 0°, 90°, 180°, 270° (4)

4. Yaw Angle: 0° (1)

B. Number of Runs (an angle of attack sweep is one run):

1. Total 44

C. Any model asymmetries detected should be corrected and flow asymmetries noted for data correction.

II. Body and Tail (rolling and non-rolling).

A. Test Conditions.

1. Mach No.: Same as I (11)

2. Angles of Attack: Same as I.

3. Roll Angles: 0°, 22.5°, 45°, 67.5°, 90° (5) except as noted

4. Yaw Angles: 0° (1)

5. Roll Rates: pd/2V = 0, 0.015, 0,030 (3)

6. Control Deflections: all 0, (1) δ R = -2°, -5° (2)

B. Number of Runs

1. $p = 0$, all $\delta = 0$, $\phi = 0°, 180°, 270°$, $M = 0.8$: 4 (asymmetry check)

2. $p \neq 0$, all $\delta = 0$ 22

3. $p = 0$, $\delta_R \neq 0$ 110

4. Total 136

C. Correct any model asymmetries detected in II. B. 1. and note flow asymmetries for data correction.

III. Body and Tail and Wing (no control deflection, non-rolling)

A. Test Conditions

1. Mach No.: 0.4, 0.8, 0.9, 0.95, 1.0 (5)

2. Angles of Attack: Same as I

3. Roll Angles: 0°, 22.5°, 45°, 67.5°, 90°, 112.5°, 135°, 157.5° (8)

4. Yaw Angles: 0° (1)

5. Roll Rates: 0 (1)

6. Control Deflections: Same as II (1)

B. Number of Runs:

1. $p = 0$, all $\delta = 0$: 40

2. Total 40

IV. Body and Tail and Wing (controls deflected, no roll rate)

A. Test Conditions are the same as the early ED plan except Match No. same as III (5)

B. Number of Runs:

1. pitch deflection only: 100

2. yaw deflection only: 100

3. roll differential deflection only: 78

4. pitch and yaw deflections: 252

5. yaw and roll deflections: 112

6. yaw and roll deflections: 112

7. pitch, yaw, and roll deflections: 224

8. Total 978

V. Dynamic Testing

A. Test Conditions

1. Mach No.:

a. Body: Same as I (11)

b. Body and Tail: Same as I (11)

c. Body and Tail and Wing: Same as III (5)

2. Roll Angles: 0°, 22.5°, 45° (3)

3. Yaw Angles: 0 (1)

4. Roll Rates: 0 (1)

5. Control Deflections: A110

6. Configurations: Body, Body and Tail, Body and Tail and Wing (3)

B. Number of Runs

1. Total 81

VI. Grand Total of Runs Required

A.	I	44
B.	II	136
C.	III	40
D.	IV	978
E.	V	81
F.	Total	1279

VII. Cost and Time

A. Model(s): $50,000 (full-scale)
+$20,000 if two tunnels are used.

B. Tunnel Times (alternatives):

1. Ames Unitary Tunnels: 656 hours

2. CALSPAN 8' x 8' and Ames 9' x 7' : 132 +30 = 162 hours

3. CALSPAN 8' x 8' and AEDC 4T: 132 +16 = 148 hours

C. Tunnel Costs

1. Ames Unitary Tunnels: 0

2. CALSPAN 8' x 8' and Ames 9' x 7' : $198K +0 = $198K

3. CALSPAN 8' x 8' and AEDC 4T: $198K + $12K = $210K

D. Total Costs (model and tunnel time)

1. Ames Unitary tunnels: $50K

2. CALSPAN 8' x 8' and Ames 9' x 7' : $268K

3. CALSPAN 8' x 8' and AEDC 4T: $280K

E. Estimated Priority Required to Obtain Tests on Time

1. High priority at national level

2. Available immediately and high national priority

3. Available immediately and medium priority at DOD level

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